Function generator
PM5108L

Instruction manual

9499 450 08202
780401/2/01/02/03

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PM 5108L

Already published: –

A. Amendment of Instruction Manual 9499 450 07602
B. Modifications of instruments from version -/01 onward
C. Modifications of instruments from version -/02 onward
D. Modifications of instruments from version -/03 onward
E. Amendment of the Parts List

A. Amendment of Instruction Manual 9499 450 07602

- Paragraph 1.2, Technical Data, pages 6, 14 and 22: The correct value of the AMPLITUDE control range is (27 ± 2) dB for both, the 600 Ω and 50 Ω - output.
- Paragraph 1.2, Technical Data, page 6: The indication accuracy of the meter must read ± 3% at 20 Hz ... 100 kHz.
- Fig. 1 2 and Fig. 13 may not be considered obligatory in all details because several modifications of the p. c. b. - layout have been realized after the manual going to press.

B. Modifications of instruments from version -/01 onward

To secure transistor, pos. 341, operating well within its specified thermal conditions the value of resistor, pos. 7 16, has been reduced to 56.2 Ω .

Aligning - range of the frequency - offset has been extended by changing values of resistors pos. 729 and 730 into 1 M Ω for pos. 729 and into 910 k Ω for pos. 730.

Resistor, pos. 612, is paralleled by an electrolytic capacitor, pos. 542, to eliminate the influence of residual frequency on the quality of the output signal.

C. Modifications of instruments from version -/02 onward

To prevent possible damage of capacitor pos. 502, another diode, BZX75 C2V8, is used in pos. 452.

D. Modifications of instruments from version -/03 onward

To keep down distortions of the output signal at very high frequencies and low settings of the AMPLITUDE controls some modifications of the circuitry have been introduced all of which are already included in the circuit diagram, fig. 14.

Unit 1

- Capacitor, pos. 522, has been transferred to another point of the circuitry *
- Capacitor, pos. 530, 22 nF, has been added *
- Capacitor, pos. 541, 22 nF, has been added *
- Capacitor, pos. 561, 22 pF, has been added *
- Resistor, pos. 684, 100 Ω , has been added
- Value of resistor, pos. 689, has been changed into 619 Ω

Unit 2

- Capacitor, pos. 561, has been eliminated *
- Microchoke, pos. 763, has been replaced by a wire-link (Fig. 13) *

Measures, marked by an asterisk, are realized provisionally in version -/01 and -/02 instruments, too.

Value of resistor pos. 665 has been altered into 68,1 k Ω to improve adjustability of the ±15 V supply voltages.

Transistor (matched pair), pos. 320, is now ON 634.

E. Amendment of the Parts List

- From version -/01 onward

Unit 1

Pos.	Old ord. no.	New ord. no.	Description
541	–	4822 122 30103	22 nF, -20 + 80%, 63 V, Ceramic plate
542	–	4822 124 20624	1 µF, -10 + 100%, 63 V, Electrolytic
561	–	4822 122 31063	22 pF, 2%, 100 V, Ceramic plate
116 5322 116 54459		5322 116 54446	56,2 Ω , 1%, MR25, Metal film

Unit 2

Pos.	Old ord. no.	New ord. no.	Description
561	4822 122 31063	–	Eliminated
729	5322 116 54698	4822 110 63187	1 MΩ , 5%, CR25, Carbon
730	5322 116 54694	4822 110 60186	910 k Ω , 5%, CR25, Carbon
763		–	Eliminated

- From version -/02 onward

Unit 1

Pos.	Old ord. no.	New ord. no.	Description
452	5322 130 34049	5322 130 34048	BZX75 - C2V8

- From version -/03 onward

Unit 1

Pos.	Old ord. no.	New ord. no.	Description
665	4822 110 63174	5322 116 54683	68,1 k Ω , 1%, MR25, Metal film
530	–	4822 122 30103	22 nF, -20+80%, 63 V, Ceramic plate
684	–	5322 116 54469	100 Ω , 1%, MR25, Metal film
689	5322 116 50571	5322 116 54529	619 Ω , 1%; MR25, Metal film
320	5322 130 44442	5322 130 44442	ON634, Matched transistor pair

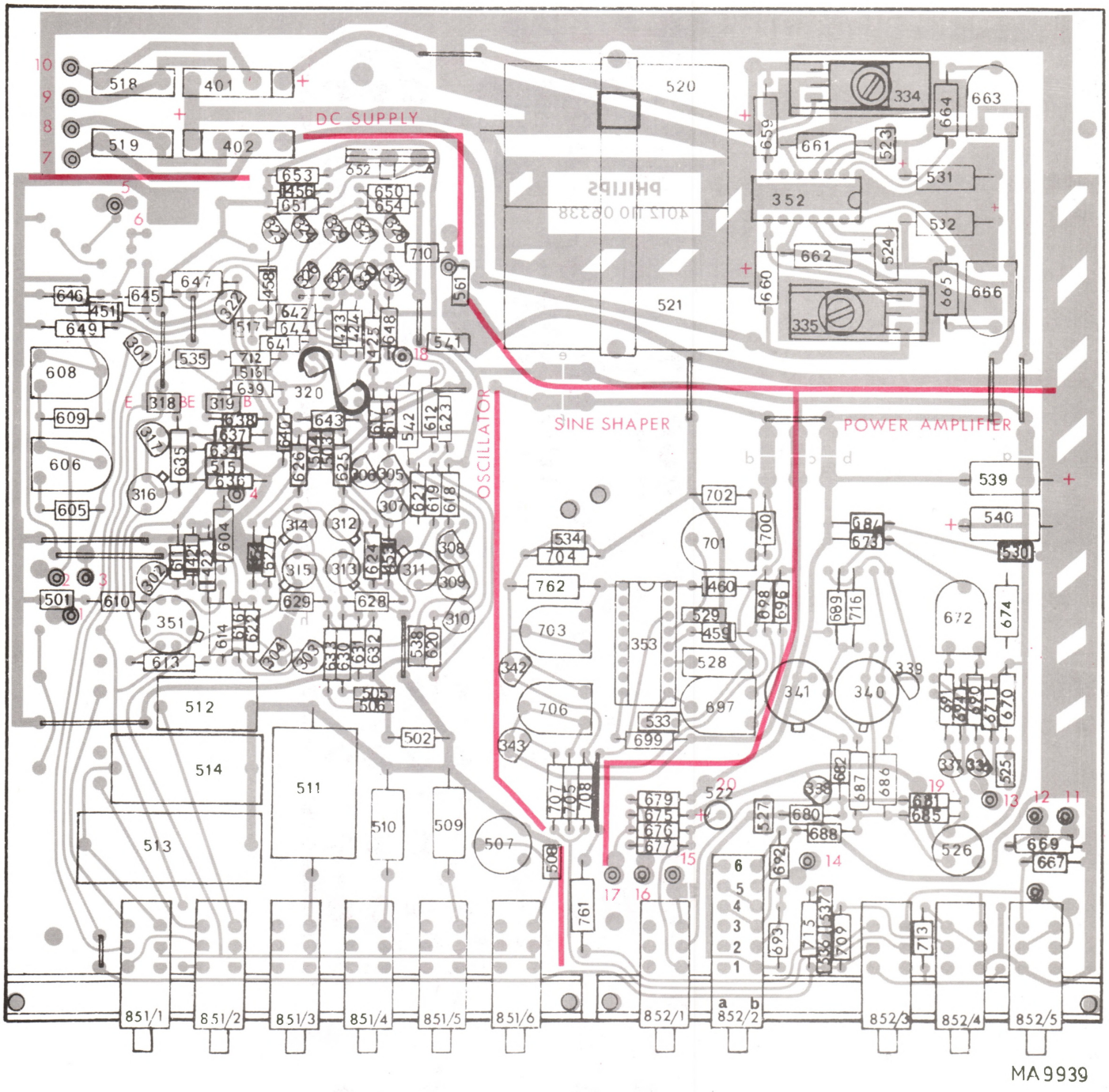

Fig. 12. Printed wiring-board, Unit 1

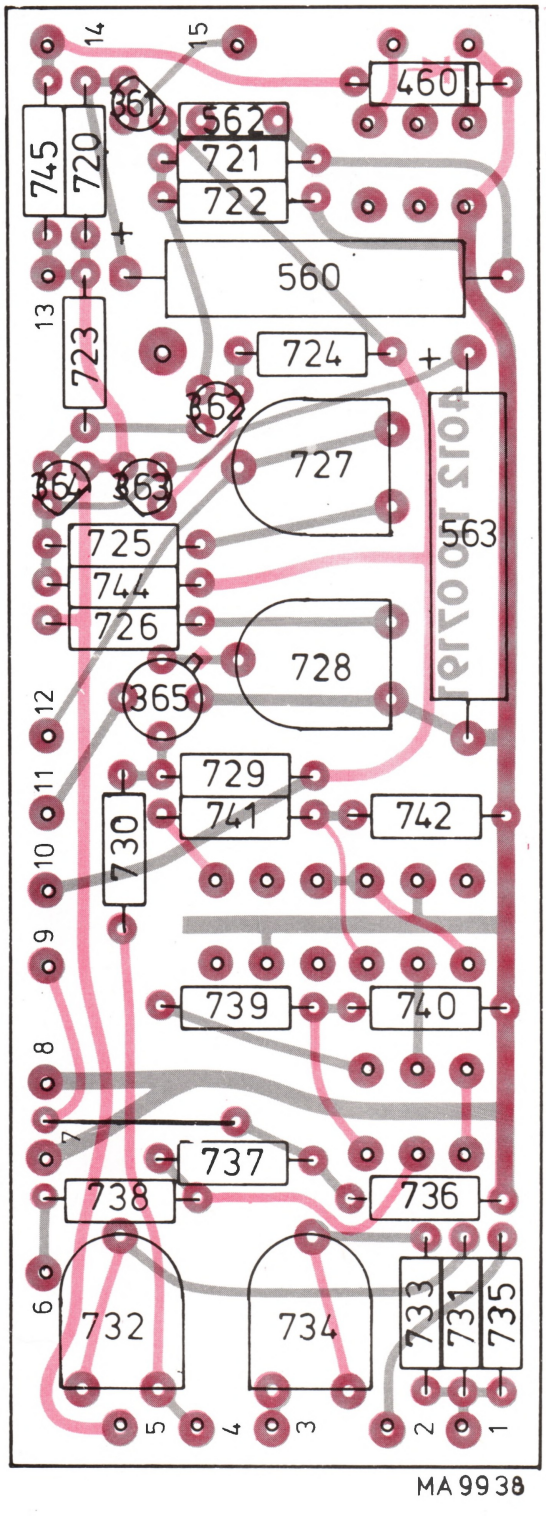

Fig. 13. Printed wiring-board, Unit 2

PHILIPS

Instruction manual
Gerätehandbuch
Notice d'emploi et d'entretien

Function generator
Funktionsgenerator
Générateur de fonctions

PM 5108L

PHILIPS

9499 450 08202

780401/2/01/02/03

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IMPORTANT

In correspondence concerning this instrument please quote the type number and the serial number as given on the type plate at the rear of the instrument.

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WICHTIG

Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und Seriennummer anzugeben. Diese befinden sich auf dem Typenschild an der Rückseite des Gerätes.

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IMPORTANT

RECHANGE DE PIECES DETACHEES
(Réparations)

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez TOUJOURS indiquer le n° de type et le n° de série qui sont marqués sur la plaquette de caractéristiques fixée sur la paroi arrière de l'appareil.

Operating manual

1. General information

1.1. INTRODUCTION

The Function Generator PM 5108L produces signals in the frequency range 0,1 Hz up to 1 MHz. The frequency can be set manually or controlled by an external signal. With the external control signal the frequency can be controlled in the ratio 1:1 up to 1:50.

Three forms of output signal are selectable, viz.: sinewave, triangular and squarewave.

The open-circuit output voltage is continuously variable up to 20 V_{pp} for output Z_o 600 Ω and up to 4 V_{pp} for output Z_o 50 Ω.
Within these ranges a d.c. voltage, continuously adjustable between −5 V and +5 V and between −1 V and +1 V respectively, can be added to the output signal.
The open-circuit output voltage is indicated by a moving coil meter.

1.2. TECHNICAL DATA

General Instructions

Only properties expressed in numerical values, with tolerances stated, are guaranteed by the factory.
All specifications will be met after a warming-up period of 30 minutes, in a constant position.
If not stated otherwise, relative tolerances (in % or ppm) relate to the adjusted value.
All specifications are valid for the measuring range only.

SPECIFICATIONS

Frequency	
Nominal range	0,1 Hz to 1 MHz
Measuring range	1 Hz to 1 MHz, divided into 6 overlapping sub-ranges
Adjustment	− Dial with linear scale 0.1 ... 10.2 − 6 Range-selector switches x1 Hz, x10 Hz to 100 Hz − FREQ. OFFSET control with scale −5 % ... +5 %
Accuracy	± 2 % ± 1 % of end of range value in ranges x1 ... x10K ± 4 % ± 1 % of end of range value in range x100K
Temperature coefficient (in nominal operating temperature range)	< 0,08 %/°C in ranges x1 to 10 kHz < 0,16 %/°C in range x100 kHz
Long-term drift within 7 hours	< 0,1 %
Short-term drift within 15 minutes	< 0,1 %
Frequency variation at nominal mains voltage ± 15 %	< 10 ppm
Waveforms	− Sinewave − Triangular wave − Squarewave
Distortion	< 0.3 % up to 100 kHz < 1.5 % in range x 100 kHz
Squarewave rise-time	< 100 ns
Squarewave overshoot and ripple (OUTPUT socket terminated with 600 Ω)	< 3 %

OUTPUT Z_o 600 Ω

Connector	BNC socket
Open-circuit output voltage	
– nominal value	20 V_{pp}
– limiting value	± 10 V for the sum of signal voltage and d.c. offset voltage, attenuator in 0 dB position.
Internal resistance	
– nominal value	600 Ω
Load capacity	
– ohmic	permanently short-circuit proof
– capacitive	arbitrary
Step attenuator	0, 20, 40, 60 dB
– accuracy	0.2 dB at 20 dB and 40 dB 0.4 dB at 60 dB
AMPLITUDE control range	(35 ± 5) dB
Temperature coefficient of the signal amplitude	< 800 ppm/°C
Amplitude response of OUTPUT (terminated with 600 Ω)	± 1 % up to 100 kHz ± 2 % up to 1 MHz < 2% step attenuator in 20 dB position < 3% step attenuator in 40 dB position
DC-offset control range (open-circuit)	–5 V ... +5 V

OUTPUT Z_o 50 Ω

Connector	BNC socket
Open-circuit output voltage	
– nominal value	4 V_{pp}
– limiting value	± 2 V for the sum of signal voltage and d.c.-offset voltage, attenuator in 0 dB position.
Internal resistance	
– nominal value	50 Ω
Load capacity	
– ohmic	permanently short-circuit proof
– capacitive	arbitrary
Step attenuator	0, 20, 40, 60 dB
– accuracy	0.2 dB at 20 dB and 40 dB 0.4 dB at 60 dB
AMPLITUDE control range	(35 ± 5 dB)
Temperature coefficient of the signal amplitude	< 800 ppm/°C
Amplitude response of OUTPUT (terminated with 50 Ω)	± 1 % up to 100 kHz ± 2 % up to 1 MHz < 2% step attenuator in 20 dB position < 3% step attenuator in 40 dB position
DC-offset control range (open-circuit)	–1 V ... +1 V
Meter	Open circuit voltage indication
– range of operation	Ranges x10 ... x100 k in the x1 range the indication is blanked
– indication accuracy at sinewave voltage	± 3 % at 20 Hz ... 100 Hz ± 5 % at 10 Hz ... 1 MHz

Input SWEEP IN

Connector	BNC socket
Input resistance	10 kΩ
Sweep-frequency ratio	1 ... ⩾ 50:1
Sweep characteristic	linear
Control voltage	Positive, 0.5 V per interval of the FREQUENCY dial, e.g. from 3 to 4. A frequency sweep can be obtained to frequencies higher than the set frequency only.
Maximum sweep-frequency	> 500 Hz, at triangular control signal and a sweep frequency ratio of the output signal of 50:1
Maximum modulation frequency (Phase-sweep < 5 %)	60 kHz (3 dB limit for frequency sweep at constant sinewave control-voltage).
Maximum permissible voltage	± 15 V

ENVIRONMENTAL CONDITIONS

Ambient temperature

– reference value	23 °C
– nominal operating temperature range	+5 to +40 °C
– temperature range for transport and storage	–40 to +70 °C
Operating position	normal or resting on tilting bracket
Supply voltage	a.c. mains
– reference value	230 V
– nominal values	115 V; 230 V
– nominal operating range	± 15 % of the selected nominal value
Frequency	50 to 100 Hz
– tolerance	± 5 %
Consumption	11 W

CABINET

Protection class (see VDE 0411)	Class 1, protective conductor
Protection type (see DIN 40 050)	IP 20

Overall dimensions

– height	145 mm
– width	240 mm
– depth	300 mm
Weight	3.5 kg

1.3. ACCESSORIES

Standard accessories	operating manual
Optional accessories	PM 9072, Cable BNC-banana (135 Ω) PM 9074, Cable BNC-BNC (50 Ω) PM 9076, Cable BNC-BNC (135 Ω) PM 9581, 50 Ω termination, 3 W

1.4. DESCRIPTION OF THE BLOCK DIAGRAM (Fig. 1)

The oscillator is formed by the CONTROLLED CURRENT SOURCE, the INTEGRATOR and the TWO-LEVEL DETECTOR. The oscillator determines the frequency of the output signal, dependent on the settings of the FREQUENCY dial, the FREQ. OFFSET control and the frequency range selector (FREQUENCY Hz).

The frequency of the oscillator can be controlled by applying an external voltage to BNC-socket SWEEP IN.

The oscillator supplies a triangular and a squarewave signal to the WAVEFORM selector. When pushbutton ~ is selected, the triangular wave signal is applied to the SINE SHAPER. The selected waveform is then available at the waveform selector output.

By means of the AMPLITUDE control, in the ATTENUATOR, the output signal can be continuously varied.

The output signal is amplified to the required level by the OUTPUT AMPLIFIER.

In the OUTPUT AMPLIFIER a continuously adjustable d.c. voltage can be added to the signal by means of the DC OFFSET control. With this control in position OFF (fully clockwise) this d.c. voltage is switched off.

The STEP ATTENUATOR following the output amplifier enables attenuation of the output signal by 20, 40 or 60 dB.

The signal available at socket OUTPUT Z_0 600 Ω has a maximum value of 20 V_{pp} and at socket OUTPUT Z_0 50 Ω a maximum value of 4 V_{pp}.

The selected open-circuit signal voltage (peak-peak) is indicated by a meter via a rectifier (METER RECTIFIER). The reading is independent of the step attenuator setting.

The POWER SUPPLY provides a stabilized voltage for the various circuits.

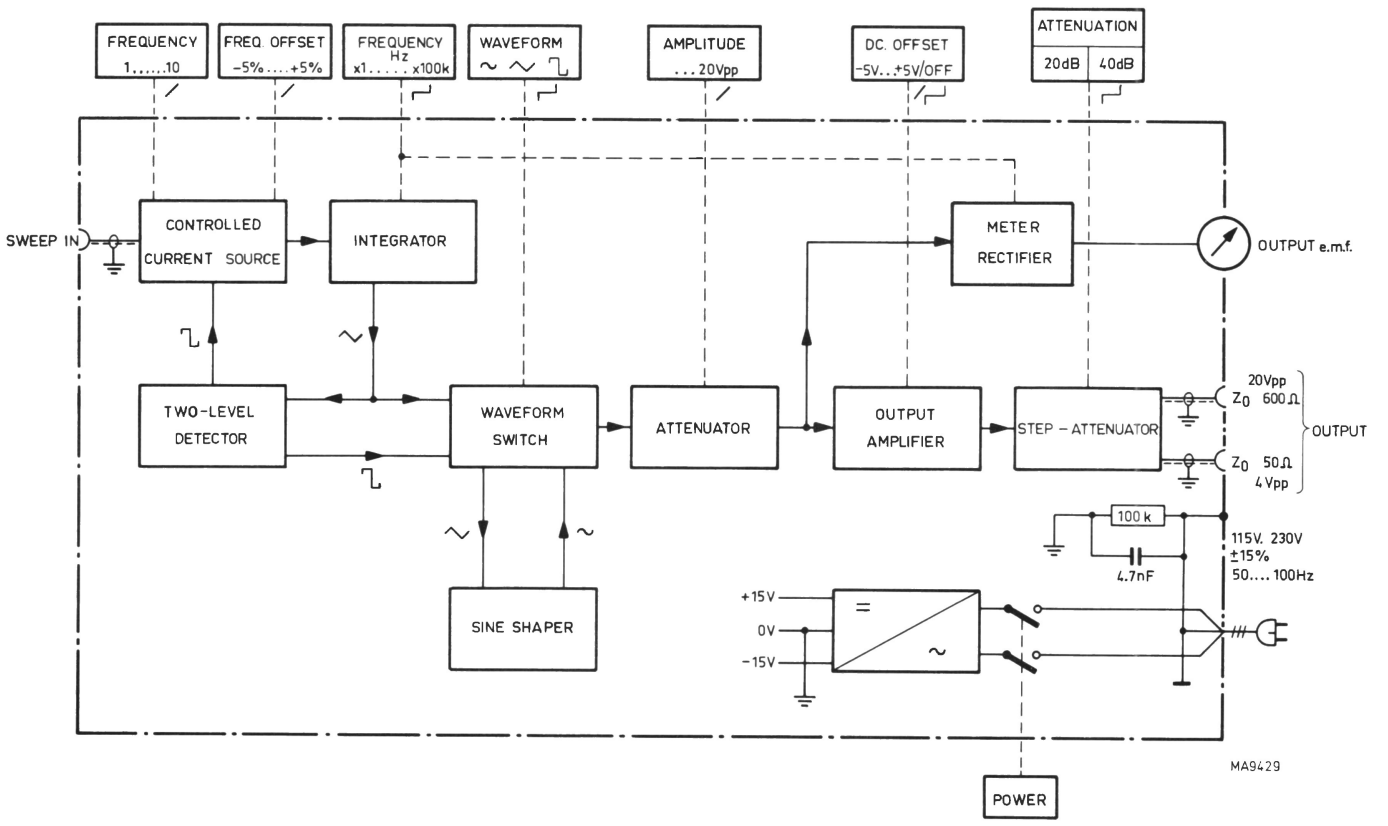


Fig. 1. Block diagram of the generator

2. Directions for use

2.1. INSTALLATION

2.1.1. **Safety regulations** (in accordance with IEC 348 or VDE 0411)

Before connecting the instrument to the mains, visually check the cabinet, controls and connectors etc., to ascertain whether any damage has occurred in transit. If there is a doubt about the efficiency of the protection, check this. If the protection is no longer guaranteed, disconnect the instrument from the mains and make it inoperative.
Always disconnect the instrument from the mains before removing any protective covers.
Any maintenance and service work necessary with the instrument switched on, should be performed by a qualified technician.
The mains connector must be plugged only into an earthed mains socket.
Do not make this safety protection ineffective, for example, by the use of an unearthed extension cable.

2.1.2. Position

The instrument may be used in any position. The accuracy of the meter, however, applies only when the instrument is positioned normally or resting on the hinged out tilting bracket.
Ensure that the ventilation holes in top and bottom plates are free from obstructions.
Do not position the instrument on any surface which produces or radiates heat.

2.1.3. Connection to the mains

The instrument must be connected only to an a.c. supply. On delivery the instrument is set to 230 V ± 15 %.
If the instrument is to be used with a 115 V ± 15 % supply, proceed as follows:
- Unplug the mains connector.
- Loosen the two screws at the rear and remove the bottom plate.
- Change the connections on the transformer in accordance with the diagram (see Fig. 2).
- Replace the bottom plate and remove the top plate.
- Change the mains-voltage plate on the rear in accordance with the mains voltage selected.
- Replace the instrument top cover.

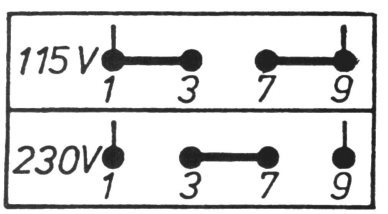


Fig. 2. Connection diagram for the different mains voltage

2.1.4. Earthing

The instrument must be earthed in conformity with the local safety regulations. The supplied mains cable contains a protective conductor which is connected to the earth contacts of the plug. The instrument must be connected to an earthed mains socket. The protective earthing of the instrument is only guaranteed when connected as described above.
The circuit earth potential of the generator (that of the external contacts of all BNC connectors) is connected to the cabinet by means of a parallel-connected capacitor and resistor. Correct HF-earthing of the circuit is then obtained.
The outer contacts of the BNC sockets may not be used to connect a protective conductor.

2.1.5. Controls and sockets (see Fig. 3)

Fig. 3. Front view, controls and sockets

2.2. OPERATION

2.2.1. Switching on the instrument

After the function generator has been connected to the mains in accordance with section 2.1.3 and 2.1.4, it may be switched on by depressing mains switch POWER.
The white spot inside the POWER switch indicates mechanically that the instrument is switched on.
After switching on, the instrument is ready for immediate use, and will meet specifications after a warming-up period of 30 minutes and at constant position.

2.2.2. Selecting the waveform

The output signals can be selected by operation of the relevant pushbutton (∼ , ⩘ , or ⎍) of the WAVEFORM selector.

2.2.3. Setting the frequency

Three controls are available for frequency setting:
1. FREQUENCY dial, with linear scale
2. Frequency-range selector, FREQUENCY Hz
3. FREQ. OFFSET control

The required nominal frequency is adjusted with the frequency dial, and the frequency range selector while the FREQ. OFFSET control must be in centre position.
The output frequency equals the product of the value on the FREQUENCY dial and the value of the selected frequency-range switch (e.g. FREQUENCY dial setting 1.9 x range switch 10 k = 19 kHz output frequency).
A detuning of −5 ... +5 % of the nominal frequency can be performed with FREQ. OFFSET control.

2.2.4. Setting the amplitude and d.c. offset

The signal amplitude at the OUTPUT BNC sockets is continuously variable to the indicated maximum output voltage by means of control AMPLITUDE.
The adjusted open-circuit voltage is indicated by the meter OUTPUT e.m.f. The voltage scale of the meter is related to output Z_0 600 Ω. The open-circuit voltage at output Z_0 50 Ω amounts to 1/5 of the indicated value.
The open-circuit voltage at the output sockets Z_0 600 Ω and Z_0 50 Ω equal the indicated value, reduced by the value of selected ATTENUATION.

Remark: With pushbutton x1 of the frequency range selector FREQUENCY Hz depressed, the indication becomes inoperative.
At a signal frequency of < 10 Hz the needle of the meter swings.

A d.c. voltage can be added to the output signal by means of control DC OFFSET. The adjustment range of this d.c. voltage in open circuit amounts to −5 V ... +5 V at output socket Z_o 600 Ω and −1 V ... +1 V at output socket Z_o 50 Ω. With control DC OFFSET in position OFF (fully clockwise) this d.c. voltage is switched off.

The output signal and the offset voltage (if required), can be attenuated by 20, 40 or 60 dB by pressing the buttons 20 dB and 40 dB ATTENUATION. For an attenuation by 60 dB, both buttons must be pressed.

Remark: By simultaneous control of AMPLITUDE and DC OFFSET the output amplifier can be overloaded. In order to guarantee the quality of the output signal, the output open-circuit voltage (step attenuator set at 0 dB) must not exceed
± 10 V at output Z_o 600 Ω and
± 2 V at output Z_o 50 Ω respectively.
With the step attenuator switched on, the limit values given, are reduced by the respective set value of attenuation.

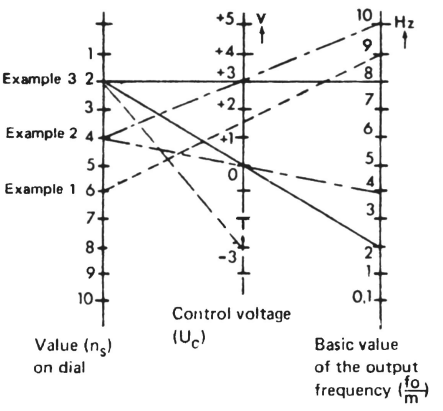
2.2.5. Frequency control (Fig. 4.)

The frequency of the generator can be controlled by applying a positive signal to input SWEEP IN. The frequency changes linearly with the control voltage as a function of the following formula:

$$f_o = m \left(n_s + \frac{2U_c}{V} \right) \text{Hz, when } 0 < \left(n_s + \frac{2U_c}{V} \right) < 10$$

where: f_o = signal frequency at the generator output
m = frequency-range selected (x1, x10 to x100 k)
n_s = frequency-dial value selected (0.1 to 10)
U_c = control voltage at SWEEP IN input

The lowest sweep frequency is set with the frequency dial, the frequency range selector (FREQUENCY Hz) and if required with FREQ. OFFSET control.
Positive control-voltages result in frequencies higher than the set frequency in accordance with the before mentioned formula.
In order to obtain a jitter-free signal (frequency- and phase-jitter results from interference on the control signal) take that the control voltage does not contain spurious components.



Example 1:

Dial set to	6
Control voltage on SWEEP IN	+ 1,5 V d.c.
Resulting output frequency	(9x range m) Hz

Example 2:

Dial set to	4
Control voltage on SWEEP IN	~ 3 V_{pp}, superimposed on a d.c. voltage of + 1,5 V
Resulting output frequency	Continuously between (4x range m) Hz and (10x range m) Hz

Example 3:

Dial set to	2
Control voltage on SWEEP IN	Squarewave of 6 V_{pp} symmetrical to zero
Resulting output frequency	During the positive period part of the control voltage (8x range m) Hz, during the negative period part of the control voltage the set value of (2x range m) Hz, because the negative period part of the control voltage do not influence the output frequency.

Fig. 4. Sweep range PM 5108L

Bedienungsanleitung

1. Allgemeines

1.1. EINLEITUNG

Der Funktionsgenerator PM 5108L erzeugt Signale im Frequenzbereich 0,1 Hz ... 1 MHz. Die Frequenz lässt sich manuell oder mit einem externen Signal einstellen. Mit dem externen Steuersignal ist die Frequenz im Verhältnis 1:1 bis über 1:50 steuerbar.
Drei Ausgangssignalformen sind wählbar, nämlich Sinus-, Dreieck- und Rechtecksignal.

Die Leerlauf-Ausgangsspannung ist für den Ausgang Z_o 600 Ω bis zu 20 V_{ss} und für den Ausgang Z_o 50 Ω bis zu 4 V_{ss} stetig einstellbar. Innerhalb dieser Bereiche kann dem Ausgangssignal eine stetig einstellbare Gleichspannung von −5 V bis +5 V bzw. −1 V bis +1 V hinzugefügt werden.

Die Leerlauf-Ausgangsspannung wird mit einem Zeigerinstrument angezeigt.

1.2. TECHNISCHE DATEN

Allgemeine Hinweise

Nur Werte mit Toleranzen oder Fehlergrenzen gelten als garantierte Daten.
Alle Spezifikationen gelten nach einer Einlaufzeit von 30 Minuten bei konstanter Gebrauchslage.
Falls nicht anders angegeben, beziehen sich relative Toleranzen (in % oder ppm) auf den eingestellten Wert.
Alle Spezifikationen gelten nur für den Messbereich.

KENNGRÖSSEN

Frequenz

Nennbereich	0,1 Hz ... 1 MHz
Messbereich	1 Hz ... 1 MHz, in 6 überlappenden Teilbereichen
Einstellmittel	– Kreisskala mit linearer Teilung 0,1 ... 10,2 – 6 Bereichtasten, x1 Hz, x10 Hz, x100 kHz – FREQ. OFFSET-Einsteller mit Skala −5 % ... +5 %
Einstellfehlergrenzen	± 2 % ± 1 % vom Bereichs-Endwert in den Bereichen x1 Hz ... x10 kHz ± 4 % ± 1 % vom Bereichts-Endwert im Bereich x100 kHz
Temperaturkoeffizient im Nenngebrauchsbereich der Umgebungstemperatur	< 0,08 %/°C in den Bereichen x1 Hz ... x10 kHz < 0,16 %/°C im Bereich x100 kHz
Langzeitdrift innerhalb von 7 Stunden	< 0,1 %
Kurzzeitdrift innerhalb von 15 Minuten	< 0,1 %
Frequenzvariation bei Netz-Nennspannung ± 15 %	< 10 ppm

Signalformen	– Sinus – Dreieck – Rechteck
Klirrfaktor	< 0,3 % bis 100 kHz < 1,5 % im Bereich x100 kHz
Anstiegzeit des Rechtecksignals	< 100 ns
Überschwingungen und Welligkeit des Rechtecksignals (bei Anschluss der Ausgänge Z_o 600 Ω und Z_o 50 Ω mit 600 Ω bzw. 50 Ω	< 3 %

Ausgang OUTPUT Z_o 600 Ω

Anschluss	BNC-Buchse
Leerlauf-Ausgangsspannung	
– Nennwert	20 V Spitze-Spitze
– Grenzwert	± 10 V für Scheitelwert der Summe aus Signalspannung und Gleichspannungs-offset, Abschwächer in Stellung 0 dB.
Innenwiderstand	
– Nennwert	600 Ω
Belastbarkeit	
– ohmisch	dauerkurzschlussfest
– kapazitiv	beliebig
Stufenabschwächer	0, 20, 40, 60 dB
– Fehler	0,2 dB bei 20 dB und 40 dB 0,4 dB bei 60 dB
Bereich des Einstellers AMPLITUDE	(35 ± 5) dB
Temperaturkoeffizient der Signalamplitude	< 800 ppm/°C
Amplitudengang der Signalamplitude (bei Abschluss des Signal-Ausgangs mit 600 Ω)	± 1 %, bis 100 kHz ± 2 %, bis 1 MHz < 2 %, Stufenabschwächer in Stellung 20 dB < 3 %, Stufenabschwächer in Stellung 40 dB
Bereich des Einstellers DC OFFSET (Leerlauf)	–5 ... +5 V

Ausgang OUTPUT Z_o 50 Ω

Anschluss	BNC-Buchse
Leerlauf-Ausgangsspannung	
– Nennwert	4 V Spitze-Spitze
– Grenzwert	± 2 V für Scheitelwert der Summe aus Signalspannung und Gleichspannungs-Offset, Abschwächer in Stellung 0 dB.
Innenwiderstand	
– Nennwert	50 Ω
Belastbarkeit	
– ohmisch	dauerkurzschlussfest
– kapazitiv	beliebig
Stufenabschwächer	0, 20, 40, 60 dB
– Fehler	0,2 dB bei 20 dB und 40 dB 0,4 dB bei 60 dB
Bereich des Einstellers AMPLITUDE	(35 ± 5) dB
Temperaturkoeffizient der Signalamplitude	< 800 ppm/°C
Amplitudengang der Signalamplitude (bei Abschluss des Ausgangs mit 50 Ω)	± 1 % bis 100 kHz ± 2 % bis 1 MHz < 2 %, Stufenabschwächer in Stellung 20 dB < 3 %, Stufenabschwächer in Stellung 40 dB
Bereich des Einstellers DC OFFSET (Leerlauf)	–1 V ... +1 V
Zeigerinstrument	Spannungsanzeige der Leerlaufspannung
– Arbeitsbereich	Bereiche x10 ... x100 k im Bereich x1 wird die Anzeige unterdrückt
– Anzeigefehler bei Sinusspannung	± 3 % bei 20 Hz ... 100 kHz ± 5 % bei 10 Hz ... 1 MHz

Eingang SWEEP IN

Anschluss	BNC-Buchse
Eingangswiderstand	10 kΩ

Sweep-Frequenzverhältnis	1 ... ⩾ 50:1
Sweep-Charakteristik	linear
Steuerspannung	positiv; 0,5 V pro bezifferten Intervall der Frequenz-Einstellskala, z.B. von 3 nach 4. Der Frequenz des Ausgangssignals liegt immer oberhalb der eingestellten Frequenz.
Maximale Sweepfrequenz	> 500 Hz, bei dreieckförmigen Steuersignal und einem Sweep-Frequenzverhältnis des Ausgangssignals von 50:1
Maximale Modulationsfrequenz (Phasenhub < 5 %)	60 kHz (3 dB-Grenze für Frequenzsweep bei konstanter sinusförmiger Steuerspannung)
Maximal zulässige Spannung	± 15 V

EINFLUSSGRÖSSEN

Umgebungstemperatur	
– Referenzwert	+23 °C
– Nenngebrauchsbereich	+5 ... +40 °C
– Grenzbereich für Lagerung und Transport	–40 ... +70 °C
Betriebslage	normal oder auf Tragbügel aufgestellt
Versorgungsspannung	Netzwechselspannung
– Referenzwert	230 V
– Nennwerte	115 V; 230 V
– Nennbetriebsbereich	± 15 % des gewählten Nennwertes
Frequenznennbereich	50 ... 100 Hz
– Toleranz	± 5 %
Leistungsaufnahme	11 W

GEHÄUSE

Schutzklasse (nach VDE 0411)	Klasse 1, Schutzleiter
Schutzart (nach DIN 40050)	IP 20
Abmessungen (gesamt)	
– Höhe	145 mm
– Breite	240 mm
– Tiefe	300 mm
Gewicht	3,5 kg

1.3. ZUBEHÖR

Normalzubehör	Gerätenhandbuch
Sonderzubehör	PM 9072, Kabel BNC-/4-mm-Stecker (135 Ω) PM 9074, Kabel BNC-BNC (50 Ω) PM 9076, Kabel BNC-BNC (135 Ω) PM 9581, 50 Ω - Abschluss, 3 W

1.4. BLOCKSCHALTBILDBESCHREIBUNG (Fig. 1)

Der Oszillator wird von der steuerbaren Stromquelle (CONTROLLED CURRENT SOURCE) dem INTEGRATOR und dem Zweipegelschalter (TWO-LEVEL DETECTOR) gebildet. Der Oszillator bestimmt die Frequenz des Ausgangssignals in Abhängigkeit von den Einstellungen der Frequenzeinstellskala (FREQUENCY), des Frequenzoffset-Einstellers (FREQ. OFFSET) und des Frequenzbereichswählers (FREQUENCY Hz).
Durch Anlegen einer externen Spannung an Buchse SWEEP IN kann die Frequenz des Oszillators gesteuert werden.
Der Oszillator gibt ein Dreieck- und Rechtecksignal an den Signalformwähler WAVEFORM ab.
Ist die Taste ~ gedrückt, wird das Dreiecksignal über den Sinusformer (SINE SHAPER) geleitet. Die gewählte Signalform steht am Signalformwähler-Ausgang zur Verfügung.
Das Ausgangssignal ist im Abschwächer (ATTENUATOR) mit dem Einsteller AMPLITUDE stetig einstellbar.
Der Ausgangsverstärker (OUTPUT AMPLIFIER) verstärkt das Signal auf den erforderlichen Wert.
Im Ausgangsverstärker kann dem Signal mit dem Einsteller DC OFFSET eine stufenlos einstellbare Gleichspannung hinzugefügt werden.
In der Raststellung OFF dieses Einstellers wird diese Gleichspannung abgeschaltet.
Der dem Ausgangsverstärker nachgeschaltete Stufenabschwächer (STEP ATTENUATOR) ermöglicht die Abschwächung des Ausgangssignals um 20, 40 oder 60 dB.
Das Signal steht an der Buchse OUTPUT $\mathbf{Z}_o$ 600 Ω mit max. 20 V_{pp} und an der Buchse OUTPUT $\mathbf{Z}_o$ 50 Ω mit max. 4 V_{pp} zur Verfügung.
Die eingestellte Leerlauf-Signalspannung (Spitze-Spitze) wird über einen Messgleichrichter (METER RECTIFIER) mit einem Zeigerinstrument angezeigt. Die Anzeige ist unabhängig von der Einstellung des Stufenabschwächers.
Das Netzteil (POWER SUPPLY) liefert die im Gerät benötigten stabilisierten Gleichspannungen.

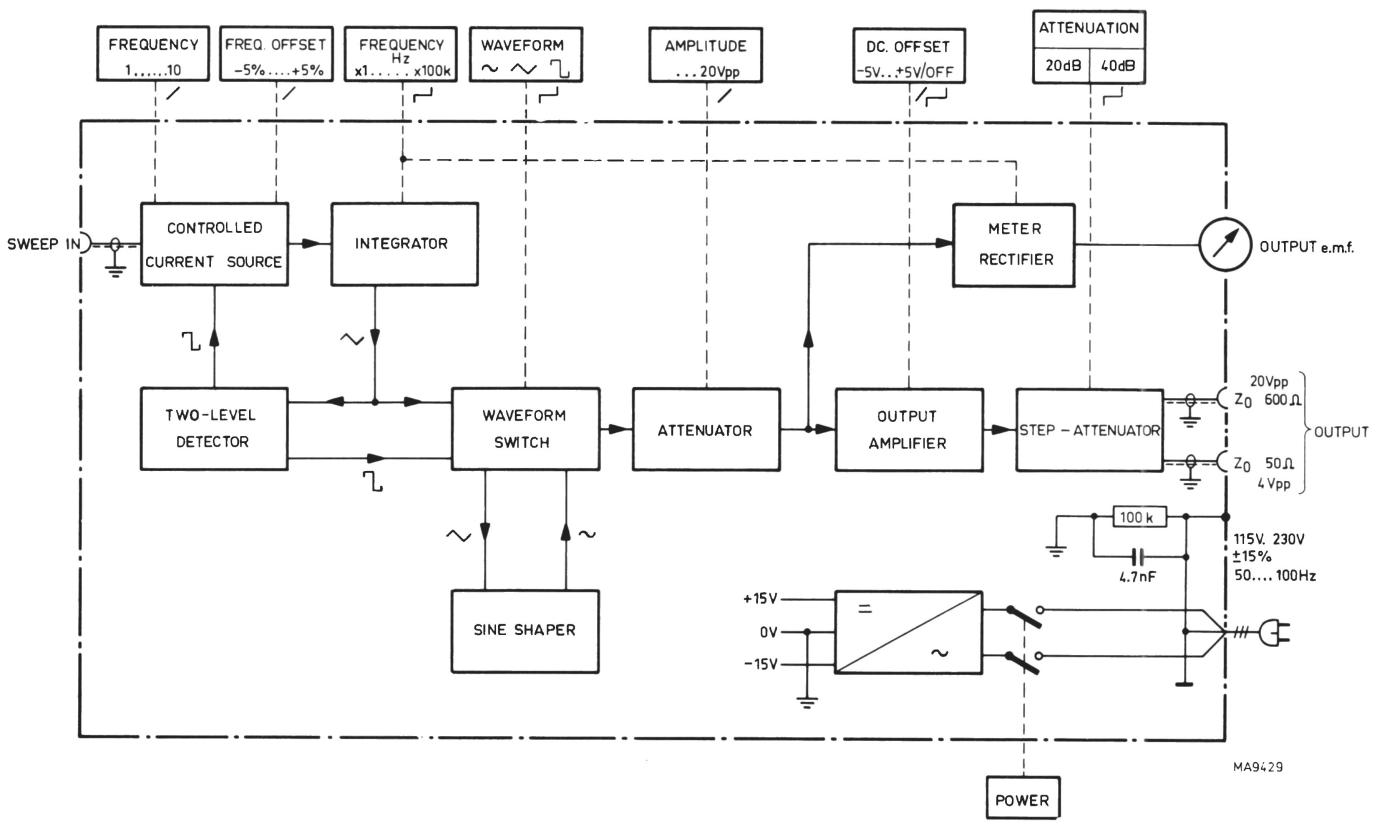


Fig. 1. Blockschaltbild des Generators

2. Gebrauchsanleitung

2.1. INBETRIEBNAHME

2.1.1. Sicherheitshinweise (siehe IEC 348 und VDE 0411)

Vor der Inbetriebnahme nach Lagerung und Transport ist darauf zu achten, dass das Gerät keine mechanischen Schäden aufweist.
Besteht der Verdacht, dass die Schutzmassnahmen nicht mehr ausreichend wirksam sind, ist deren Wirksamkeit zu prüfen.
Ist der Schutz nicht mehr sichergestellt, so ist das Gerät ausser Betrieb zu nehmen und gegen Inbetriebnahme zu sichern.
Das Gerät ist vor dem Öffnen vom Netz zu trennen.
Wartungs- und Überholungsarbeiten dürfen nur unter Beachtung der gebotenen Vorsichtsmassnahmen durch eingearbeitete Fachleute ausgeführt werden.
Der Netzanschlussstecker darf nur in eine Schutzkontaktsteckdose gesteckt werden; diese Schutzmassnahme darf nicht unwirksam gemacht werden; z.B. durch eine unvolkommene Verlängerungsleitung.

2.1.2. Aufstellen

Das Gerät darf in beliebiger Lage aufgestellt und betrieben werden. Mit Hilfe des heruntergeklappten Tragbügels kann das Gerät in nach hinten gekippter Lage aufgestellt werden.
Die Fehlergrenzen des Anzeigeinstruments werden jedoch nur bei Aufstellung in Normallage bzw. auf den heruntergeklappten Tragbügel eingehalten.
Die Belüftungsöffnungen in Bodenplatte und Deckel dürfen nicht verdeckt werden. Es ist ferner darauf zu achten, dass das Gerät nicht auf andere Wärmequellen gestellt oder übermässiger Wärmeeinstrahlung ausgesetzt wird.

2.1.3. Netzanschluss

Das Gerät darf nur an Wechselspannung betrieben werden. Bei Auslieferung ist das Gerät auf eine Netzspannung von 230 V ± 15 % eingestellt.
Soll das Gerät an einer Netzspannung von 115 V ± 15 % betrieben werden, ist wie folgt zu verfahren:
- Netzstecker ziehen.
- Gehäuseboden abnehmen, dazu zwei Schrauben an der Rückseite entfernen.
- Die Transformatoranschlüsse entsprechend dem Schema (Fig. 2) umlöten.
- Gehäusedeckel abnehmen, dazu zwei Schrauben der Rückseite entfernen.
- Netzspannungsschild an der Rückwand entsprechend der eingestellten Netzspannung montieren.
- Gerät schliessen.

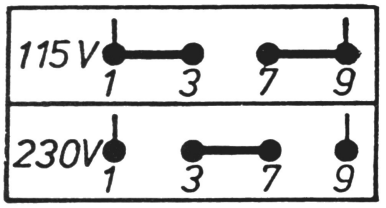


Fig. 2. Anschlussschaltbild für die verschiedenen Netzspannungen

2.1.4. Erden

Die Schutzerdung des Gerätes muss den örtlichen Vorschriften entsprechend vorgenommen werden.
Die mit dem Gerät fest verbundene Netzzuleitung enthält einen Schutzleiter und ist mit einem Schutzkontakt-Stecker versehen. Dieser Stecker muss mit einer Schutzkontakt-Steckdose verbunden werden. Nur auf diese Weise ist eine wirksame Schutzerdung des Gerätes gewährleistet.
Das Schaltungsnullpunkt-Potential des Generators, auf dem die Aussenkontakte aller BNC-Buchsen liegen, ist mit dem Gehäuse über die Parallelschaltung eines Kondensators und eines Widerstandes verbunden. Damit wird eine eindeutige HF-Erdung der Schaltung bewirkt. Die Aussenkontakte der BNC-Buchsen dürfen nicht für Anschluss eines Schutzleiters verwendet werden.

2.1.5. Bedienungselemente und Anschlüsse (siehe Fig. 3)

Fig. 3. Frontansicht, Bedienungselemente und Anschlüsse

2.2. BEDIENUNG

2.2.1. Einschalten des Gerätes

Nachdem der Funktionsgenerator, entsprechend Abschnitt 2.1.3 und 2.1.4. mit dem Netz verbunden ist, kann er durch Drücken des Schalters POWER eingeschaltet werden.
Das weisse Feld im Schalter POWER gibt mechanisch an, dass das Gerät eingeschaltet ist.
Nach dem Einschalten ist das Gerät für sofortigen Gebrauch bereit. Es erfüllt seine technischen Daten nach einer Einlaufzeit von 30 Minuten bei unveränderter Lage.

2.2.2. Wählen der Signalform

Die Grundform des Ausgangssignals wird durch Drücken der entsprechenden Taste (∼ ∿ , ⊓) des Signalform-Wählers WAVE FORM eingestellt.

2.2.3. Einstellen der Frequenz

Zur Einstellung der Frequenz stehen drei Einstellmittel zur Verfügung:
1. Frequenz-Einsteller mit Kreisskala
2. Frequenz-Bereichsschalter FREQUENCY Hz
3. Frequenz-Offset-Einsteller FREQ. OFFSET

Mit Frequenz-Einsteller und mit Frequenz-Bereichsschalter FREQUENCY Hz wird die gewünschte Sollfrequenz eingestellt, der Einsteller FREQ. OFFSET muss dabei in Mittelstellung stehen.
Die Ausgangsfrequenz ist gleich dem Produkt aus dem Zahlenwert auf der Kreisskala und dem Zahlenwert der gedrückten Taste des Frequenz-Bereichsschalter (Beispiel: Einstellung 1.9 x Bereichsschalter x 10 k = Ausgangsfrequenz 19 kHz).
Mit dem Einsteller FREQ. OFFSET kann eine Feineinstellung der Frequenz von –5 ... +5 % vorgenommen werden.

2.2.4. Einstellen der Amplitude und des DC-Offset

Die Signalamplitude an den BNC-Buchsen OUTPUT ist mit dem Einsteller AMPLITUDE auf die jeweils angegebene maximale Ausgangsspannung stetig einstellbar.
Die eingestellte Leerlaufspannung wird mit dem Zeigerinstrument OUTPUT e.m.f. angezeigt. Die Spannungsskala des Zeigerinstruments bezieht sich auf den Ausgang Z_0 600 Ω. Die Leerlaufspannung am Ausgang Z_0 50 Ω beträgt 1/5 des angezeigten Werts.
Die Leerlauf-Signalspannung an den Ausgangsanschlüssen Z_0 600 Ω und Z_0 50 Ω ist um den eingestellten Wert des Stufenabschwächers ATTENUATION geringer als der angezeigte Wert.

Anmerkung: Bei gedrückter Taste x1 des Frequenz-Bereichsschalters FREQUENCY Hz ist die Anzeige ausser Betrieb.
Bei einer Signalfrequenz < 10 Hz pendelt der Zeiger des Instruments.

Mit dem Einsteller DC OFFSET kann dem Ausgangssignal eine Gleichspannung hinzugefügt werden. Der Einstellbereich dieser Gleichspannung beträgt im Leerlauf –5 V bis +5 V an der Ausgangsbuchse $\mathbf{Z}_0$ 600 Ω und –1 V bis +1 V an der Ausgangsbuchse $\mathbf{Z}_0$ 50 Ω. In der Raststellung OFF des Einstellers DC OFFSET ist diese Gleichspannung abgeschaltet.

Das Ausgangssignal, ggf. einschliesslich der Offsetspannung kann durch Drücken der Tasten 20 dB und 40 dB des Stufenabschwächers ATTENUATION um 20, 40 oder 60 dB abgeschwächt werden. Für eine Abschwächung von 60 dB müssen beide Tasten gedrückt sein.

Bemerkung: Der Ausgangsverstärker ist durch gleichzeitige Ansteuerung von Signalspannung und Offset-Gleichspannung übersteuerbar.
Um ein einwandfreies Ausgangssignal zu erhalten, darf der absolute Grenzwert der Leerlauf-Ausgangsspannung (Stufenabschwächer auf 0 dB)
± 10 V am Ausgang $\mathbf{Z}_0$ 600 Ω, bzw.
± 2 V am Ausgang $\mathbf{Z}_0$ 50 Ω
nicht überschreiten.
Beim eingeschaltetem Stufenabschwächer erniedrigen sich die angegebenen Grenzwerte um den jeweils eingestellten Wert der Abschwächung.

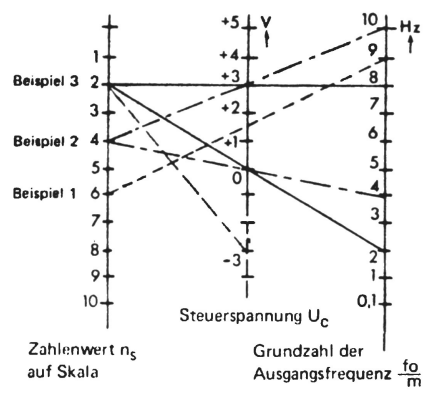
2.2.5. Frequenzsteuerung (Fig. 4)

Durch Einspeisen eines positiven Signals in den Eingang SWEEP IN kann die Frequenz des Generators gesteuert werden. Die Frequenz ändert sich dabei linear mit der Steuerspannung nach der Funktion:

$$f_0 = m\left(n_s + \frac{2U_c}{V}\right) \text{Hz, wenn } 0 < \left(n_s + \frac{2U_c}{V}\right) < 10$$

darin ist f_0 = Signalfrequenz am Generatorasugang
m = eingestellter Frequenzbereich (x1, x10 ... x100 k)
n_s = an der Skala eingestellter Zahlenwert (0,1 ... 10)
U_c = Steuerspannung am Eingang SWEEP IN

Mit dem Frequenz-Einsteller, dem Frequenz-Bereichsschalter und ggf. dem Frequenz-Offset-Einsteller wird die Frequenz der unteren Hubgrenze eingestellt. Positive Werte der Steuerspannung ergeben entsprechend vorher angeführte Formel Ausgangssignalfrequenzen oberhalb der eingestellten Frequenz.
Um an der unteren Hubgrenze ein jitterfreies Signal zu erhalten (Frequenz- und Phasenjitter ist eine Folge von Störspannungen auf dem Steuersignal) ist darauf zu achten, dass das zugeführte Signal möglichst störspannungsfrei ist.



Beispiel 1:

Skala eingestellt auf	6
Steuerspannung an SWEEP IN	Gleichspannung + 1,5 V
Ausgangsfrequenz	(9x Bereich m) Hz

Beispiel 2:

Skala eingestellt auf	4
Steuerspannung an SWEEP IN	Sinusspannung 3 Vss, mit einer Gleichspannung von + 1,5 V überlagert
Ausgangsfrequenz	stufenlos zwischen den Hubgrenzen (4x Bereich m) Hz und (10x Bereich m) Hz

Beispiel 3:

Skala eingestellt auf	2
Steuerspannung an SWEEP IN	nullsymmetrische Rechteckspannung von 6 Vss
Ausgangsfrequenz	während des positiven Periodenteils der Steuerspannung (8x Bereich m) Hz, während des negativen Periodenteils der Steuerspannung der eingestellten Wert von (2x Bereich m) Hz, da der negative Teil die Ausgangsfrequenz nicht beeinflusst.

Fig. 4. Sweepbereich PM 5108 L

Notice d'emploi

1. Généralités

1.1. INTRODUCTION

Le générateur de fonctions PM 5108L offre une large gamme de fréquence de 0,1 Hz à 1 MHz. Cette fréquence peut être commandée manuellement ou par un signal externe. Le signal de commande externe permet de piloter la fréquence dans un rapport 1:1 à 1:50 et plus.
Les signaux de sortie peuvent être sélectionnés: sinusoïdaux, triangulaires ou rectangulaires.

La tension en circuit ouvert est continuellement variable jusqu'à 20 V_{CC} pour sortie Z_O 600 Ω et jusqu'à 4 V_{CC} pour sortie Z_O 50 Ω.
Dans ces gammes, une tension continue réglable de –5 V à +5 V et de –1 V à +1 V respectivement peut être ajoutée au signal de sortie.
La tension de sortie en circuit ouvert est indiquée à l'aide d'un index.

1.2. CARACTERISTIQUES TECHNIQUES

Instructions générales

Les propriétés exprimées en valeurs numériques avec tolérances sont garanties par l'usine. Les valeurs sans tolérances sont données à titre indicatif et correspondent aux caractéristiques d'un appareil moyen.
A moins qu'indiquées différemment, les tolérances relatives (en % ou ppm) se réfèrent à la valeur réglée.
Toutes les spécifications ne sont valable que pour la gamme de mesure.

Fréquence

Plage	0,1 Hz à 1 MHz
Gamme de mesure	1 Hz à 1 MHz en 6 sous-gammes se chevauchant
Réglage	– cadran avec échelle linéaire 0,1 à 10,2 – 6 sélecteurs de gamme, x1 Hz, x10 Hz à x100 kHz – potentiomètre FREQ. OFFSET, échelle –5 % ... +5 %
Précision	± 2 % ± 1 % fin de gamme dans les gammes x1 ... x10 k ± 4 % ± 1 % fin de gamme dans la gamme x100 k
Coefficient de température (gamme de fonctionnement nominale)	< 0,08 %/°C dans la gamme x1 Hz à 10 kHz < 0,16 %/°C dans la gamme x100 kHz
Dérive à long terme dans les 7 heures	< 0,1 %
Dérive à court terme dans les 15 minutes	< 0,1 %
Variation de fréquence à la tension secteur nominale ± 15 %	< 10 ppm
Signaux	– sinusoïdal – triangulaire – rectangulaire
– distorsion	< 0,3 % jusqu'à 100 kHz < 1,5 % dans la gamme x100 kHz
– temps de montée rectangulaire	< 100 ns

Sortie Z_o 600 Ω

Connecteur	douille BNC
Tension de sortie en circuit ouvert	
– valeur nominale	20 V_{cc}
– valeur limite	± 10 V pour valeur limite de la somme tension de signal + offset de tension continue, atténuateur en position 0 dB.
Résistance interne	
– valeur nominale	600 Ω
Capacité de charge	
– ohmique	en permanence exempt du courts-circuits
– capacitive	arbitraire
Atténuations par échelons	0, 20, 40, 60 dB
– précision	0,2 dB à 20 dB et 40 dB 0,4 dB à 60 dB
Gamme AMPLITUDE	(35 ± 5) dB
Coefficient de température du signal d'amplitude	< 800 ppm/°C
Réponse d'amplitude à la douille OUTPUT (chargé à 600 Ω)	± 1 % jusqu'à 100 kHz ± 2 % jusqu'à 1 MHz < 2 %, atténuateur en position 20 dB < 3 %, atténuateur en position 40 dB
Gamme d'offset continu (circuit ouvert)	–5 ... +5 V

Sortie Z_o 50 Ω

Connecteur	douille BNC
Tension de sortie en circuit ouvert	
– valeur nominale	4 V_{cc}
– valeur limite	± 2 V pour valeur limite de la somme tension de signal + offset de tension continue, atténuateur en position 0 dB
Résistance interne	
– valeur nominale	50 Ω
Capacité de charge	
– ohmique	en permanence exempt de courts-circuits
– capacitive	arbitraire
Atténuation par échelons	0, 20, 40, 60 dB
– précision	0,2 dB à 20 dB et 40 dB 0,4 dB à 60 dB
Gamme AMPLITUDE	(35 ± 5) dB
Coefficient de température du signal d'amplitude	< 800 ppm/°C
Réponse d'amplitude à la douille OUTPUT (chargé à 600 Ω)	± 1 % jusqu'à 100 kHz ± 2 % jusqu'à 1 MHz < 2 %, atténuateur en position 20 dB < 3 %, atténuateur en position 40 dB
Gamme d'offset continu (circuit ouvert)	–1 V ... +1 V

Entrée SWEEP IN

Connecteur	douille BNC
Résistance d'entrée	10 kΩ
Gamme de balayage	1 ... ⩾ 50:1
Caractéristique de balayage	linéaire

Tension de commande	Positive, 0,5 V par intervalle chiffré du cadran FREQUENCY, p.ex. de 3 à 4. Un balayage de fréquence peut uniquement être obtenu vers des fréquences supérieures à la fréquence réglée.
Fréquence maxi de balayage	> 500 Hz, pour signal triangulaire et un rapport de fréquence de balayage du signal de sortie 50:1.
Fréquence maxi de modulation (balayage de phase < 5 %)	60 kHz (limite 3 dB pour balayage de fréquence à tension sinusoïdale constante)
Tension maximale admise	± 15 V
Index	Tension en circuit ouvert
– Gamme de fonctionnement	Gammes x10 ... x100 k; dans la gamme x1 l'indication est supprimée
– Erreur d'indication pour tension sinusoïdale	± 3 % à 20 Hz ... 100 kHz ± 5 % à 10 Hz ... 1 MHz

CONDITIONS D'ENVIRONNEMENT

Température ambiante	
– valeur de référence	23 °C
– de fonctionnement nominal	+5 à +40 °C –40 à +70 °C
Position de travail	normale ou inclinée à l'aide de l'étrier-support
Tension d'alimentation	secteur alternatif
– valeur de référence	230 V
– valeurs nominales	115 V;230 V
– gamme de fonctionnement nominal	± 15 % de la valeur nominal choisie
Fréquence	50 à 100 Hz
– tolérance	± 5 %
Consommation	11 W

COFFRET

Classe de protection (VDE 0411)	Classe 1, conducteur de protection
Type de protection (DIN 40 050)	IP 20
Dimensions totales	
– hauteur	145 mm
– largeur	240 mm
– profondeur	300 mm
Poids	3,5 kg

1.3. ACCESSOIRES

Fourni avec l'appareil	mode d'emploi
Fournis en option	PM 9072, Cable BNC-banane (135 Ω) PM 9074, Cable BNC-BNC (50 Ω) PM 9076, Cable BNC-BNC (135 Ω) PM 9581, résistance terminale (3 W)

1.4. DESCRIPTION DU SCHEMA SYNOPTIQUE (Fig. 1)

L'oscillateur est composé d'une source de courant pilotée (CONTROLLED CURRENT SOURCE), d'un intégrateur (INTEGRATOR) et d'un détecteur double niveau (TWO-LEVEL DETECTOR). Cet oscillateur produit et détermine la fréquence du signal de sortie en fonction du réglage du cadran FREQUENCY, de la commande FREQ. OFFSET et du sélecteur FREQUENCY Hz (gamme de fréquence).

La fréquence de l'oscillateur peut être commandée en appliquant une tension externe à la douille BNC SWEEP IN.

L'oscillateur fournit un signal triangulaire et rectangulaire au sélecteur WAVEFORM. Lorsque le bouton-poussoir ~ est enfoncé, le signal triangulaire est appliqué au conformateur d'impulsions sinusoïdales (SINE SHAPER). La forme d'onde sélectionnée est alors disponible à la sortie du sélecteur de forme d'onde.

La commande AMPLITUDE dans l'atténuateur (ATTENUATOR) permet de varier le signal de sortie d'une façon continue.

Le signal de sortie est amplifié au niveau requis par l'amplificateur de sortie (OUTPUT AMPLIFIER). Dans ce dernier, une tension continue variable peut être ajoutée au signal à l'aide de la commande DC OFFSET.

En position OFF de cette commande, cette tension continue est déconnectée. Le signal amplifié est appliqué à l'atténuateur par échelons, lequel est capable d'atténuer le signal de sortie de 20, 40 ou 60 dB.

Le signal est disponible à la douille OUTPUT $\mathbf{Z}_o$ 600 Ω: 20 V_{cc} et à la douille OUTPUT $\mathbf{Z}_o$ 50 Ω: 4 V_{cc} max.

La tension sélectionnée en circuit ouvert (crête-à-crête) est indiquée par un index par l'intermédiate d'un redresseur (METER RECTIFIER). L'affichage est indépendant du réglage de l'atténuateur par échelons.

L'alimentation fournit une tension stabilisée pour les différents circuits.

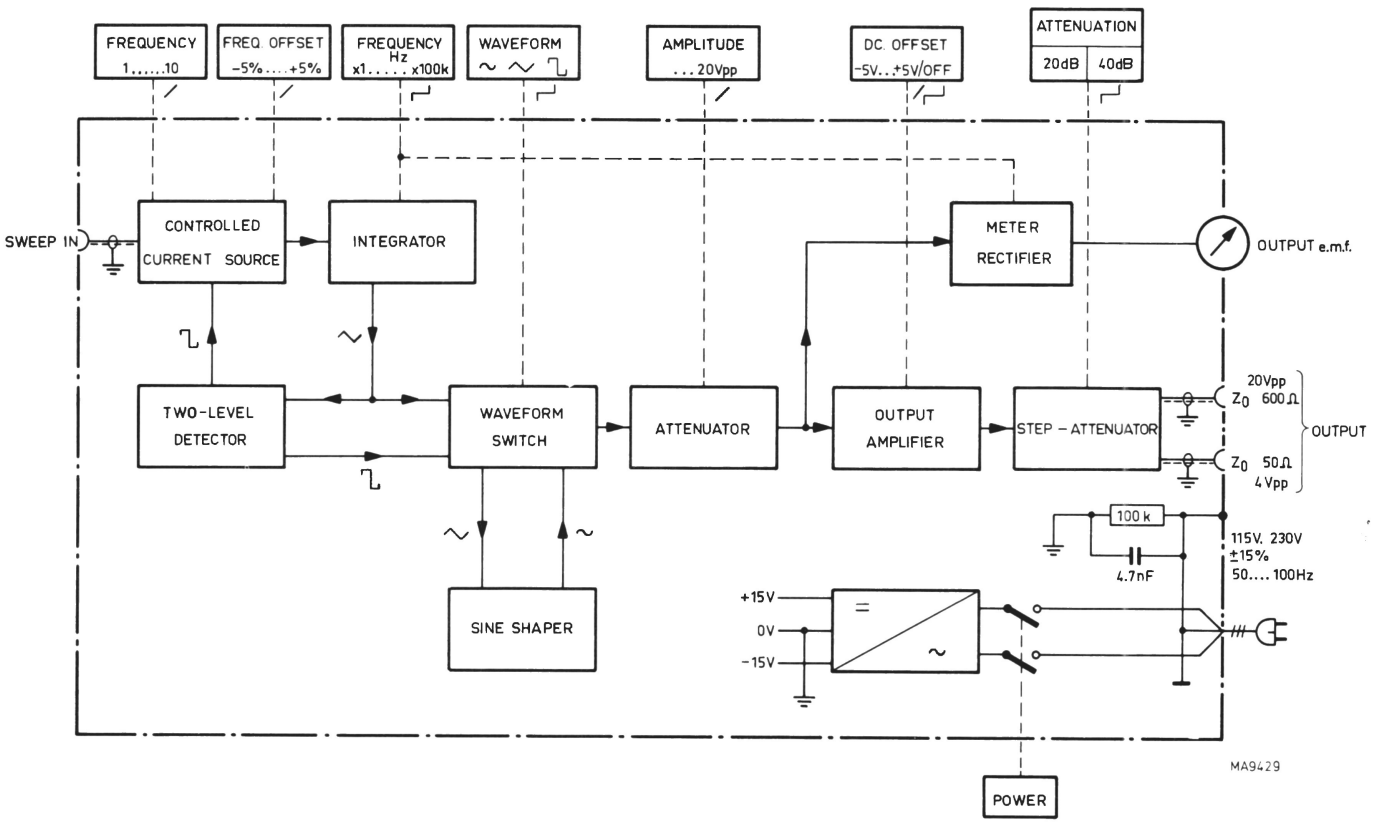


Fig. 1. Schéma synoptique du générateur

2. Mode d'emploi

2.1. INSTALLATION

2.1.1. **Règles de sécurité** (normes IEC 238 et VDE 0411)

Avant d'utiliser l'appareil après stockage et transport, vérifier s'il présente des dommages matériels.
Au cas où un doute subsisterait quant à l'efficacité de la protection, contrôler ce point.
Si la protection n'est pas assurée, l'appareil doit être débranché du secteur.
L'appareil doit toujours être débranché avant de l'ouvrir.
Les travaux d'entretien et de maintenance à effectuer sur un appareil alimenté ne peuvent être réalisés que par un technicien qualifié.
La fiche secteur ne peut être mise que dans une prise secteur avec contact de terre.
Cette sécurité ne peut pas être supprimée, même avec un câble de prolongement inadéquat par exemple.

2.1.2. Position

L'appareil doit être placé tel quel ou incliné après avoir pivoté l'étrier-support. La précision de l'appareil ne s'applique que dans ces cas.
Les ouvertures de ventilation dans les plaques supérieure et inférieure ne peuvent pas être recouvertes.
Veiller à ne pas mettre l'appareil sur des objets produisants de la chaleur.

2.1.3. Branchement au secteur

L'appareil ne peut être alimenté qu'en alternatif.
A la livraison, il est réglé sur 230 V ± 15 %.
En cas d'utilisation sur 115 V ± 15 %, procéder comme suit:
- Débrancher la fiche secteur.
- Enlever la plaque de base après avoir dévissé les deux vis à l'arrière.
- Modifier le circuit du primaire en fonction du schéma (Fig. 2).
- Remettre la plaque de base et enlever le couvercle.
- Changer la plaquette de tension secteur à l'arrière conformément à la tension réglée.
- Fermer l'appareil.

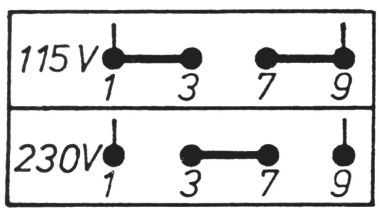


Fig. 2. Schéma de branchement pour différentes tensions d'alimentation

2.1.4. Mise à la terre

La protection terre du générateur doit répondre aux régles de sécurité locales. Le cordon secteur livré présente un conducteur de protection relié au contact terre de la fiche. Cette fiche ne peut donc être branchée que sur une prise secteur à contact de terre. La protection terre de l'appareil n'est garantie que de cette façon.
Le potentiel zéro du générateur (contacts externes des connecteurs BNC) est relié au boîtier par l'intermédiaire d'un circuit parallèle RC.
Une mise à la terre HF correct est ainsi obtenue.
Les contacts externes BNC ne peuvent pas être utilisés à la connexion d'un conducteur de protection.

2.1.5. Bornes et réglages (voir Fig. 3)

Fig. 3. Vue de face, bornes et réglages

2.2. MODE D'EMPLOI

2.2.1. Mise en service

Brancher le générateur selon 2.1.3 et 2.1.4 et mettre l'appareil en service en enfonçant le bouton POWER.
La partie blanche du bouton POWER indique que l'appareil est en service.
Après sa mise en service, l'appareil est prêt à l'usage et répond aux spécifications après une période de chauffage de 30 minutes.

2.2.2. Sélection de la forme d'onde

Les signaux de sortie sont sélectionnés en enfonçant le bouton correspondant (∼ , ⋀ , ⎍) du sélecteur WAVEFORM.

2.2.3. Réglage de fréquence

La fréquence peut être réglée de trois façons:
1. par la commande FREQUENCY avec l'échelle
2. par le commutateur de gamme FREQUENCY Hz
3. par la commande de variation de fréquence FREQ. OFFSET

Dans les deux premiers cas la fréquence nominale requise est réglée, la commande de variation de fréquence étant réglée en position médiane.
La fréquence de sortie est égale au produit de la valeur sur l'échelle FREQUENCY et de la valeur de commutateur de gamme (exemple: échelle FREQUENCY 1.9x commutateur de gamme 10 k = fréquence de sortie 19 kHz).
Une variation de fréquence peut être obtenue à l'aide de la commande de variation de fréquence, à savoir de −5% à +5% de la valeur nominale.

2.2.4. Réglage d'amplitude et d'offset continu

L'amplitude aux bornes BNC OUTPUT est continuellement réglable sur la tension de sortie maximale à l'aide de la commande AMPLITUDE.
La tension en circuit ouvert réglée est indiquée à OUTPUT f.e.m. de l'appareil. L'échelle de tension de l'appareil a rapport à la sortie Z_0 600 Ω.
La tension en circuit ouvert à la sortie Z_0 50 Ω est 1/5 la valeur indiquée.
La tension en circuit ouvert à ces deux sorties est égale à la valeur indiquée divisée par le facteur d'atténuation.

Remarque: Lorsqu'on enfonce la touche x1 du sélecteur de gammes de fréquence FREQUENCY Hz, l'indication n'est plus fonctionnelle.
A fréquence < 10 Hz, l'aiguille du mètre oscille.

Avec la commande DC OFFSET une tension continue peut être ajoutée au signal de sortie. La gamme de réglage de cette tension continue en circuit ouvert est de –5 V à +5 V à la douille Z_o 600 Ω et de –1 V à +1 V à la douille Z_o 50 Ω. En position OFF de la commande DC OFFSET, la tension continue est déconnectée. Le signal de sortie et, au besoin, la tension offset, peut être atténué de 20, 40 ou 60 dB en enfonçant les touches 20 dB et 40 dB de l'atténuateur par échelons ATTENUATION. Pour une atténuation de 60 dB, il faut enfoncer les deux touches.

Attention: En cas de commande simultanée de AMPLITUDE et DC OFFSET, l'amplificateur de sortie peut être surchargé. Pour garantir la qualité du signal de sortie, l'atténuateur étant réglé sur 0 dB, la tension de sortie en circuit ouvert ne doit pas excéder.
± 10 V à la sortie Z_o 600 Ω
± 2 V à la sortie Z_o 50 Ω
En cas d'atténuateur en circuit, les limites données sont réduites par la valeur d'atténuation réglée.

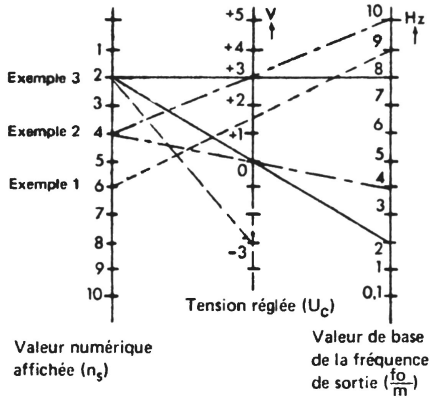
2.2.5. Commande de fréquence (Fig. 4)

La fréquence du générateur peut être réglée en appliquant un signal à l'entrée SWEEP IN. La fréquence varie linéairement avec la tension de commande selon la fonction:

$$f_o = m\left(n_s + \frac{2U_c}{V}\right) \text{Hz, lorsque } 0 < \left(n_s + \frac{2U_c}{V}\right) < 10$$

f_o = fréquence du signal de sortie
m = facteur réglé avec le commutateur de gamme (x1, x10 à 100 k)
n_s = valeur réglée sur l'échelle (0.1 à 10)
U_c = tension de commande à l'entrée SWEEP IN

La fréquence de balayage la plus basse est réglée avec la commande de fréquence (cadran de fréquence), le sélecteur de gamme (FREQUENCY Hz) et, au besoin, avec la commande FREQ. OFFSET. Les valeurs de tension de commande positive donnent des fréquences supérieures à la fréquence réglée selon la formule ci-avant.
Afin d'obtenir un signal sans jitter, lequel jitter résulte de petites interférences sur le signal de commande, veiller à ce que le tension de commande ne soit soumis à aucune interférence.



Exemple 1:

Echelle réglée sur	6
Tension réglée sur SWEEP IN	+ 1,5 V en continu
Fréquence de sortie	(9x gamme m) Hz

Exemple 2:

Echelle réglée sur	4
Tension réglée sur SWEEP IN	3 V_{cc} sinussoïdal, superposée sur une tension continue de 1,5 V
Fréquence de sortie	Continue entre les limites (4x gamme m)Hz et (10x gamme m) Hz

Exemple 3:

Echelle réglée sur	2
Tension réglée sur SWEEP IN	Tension rectangulaire 6 V_{cc} symétrique à zéro
Frequence de sortie	Pendant la partie positive de la tension de commande (8x gamme m) Hz, pendant la partie négative de la tension de commande = Valeur réglée (2x gamme m) Hz, car la partie négative n' influence pas la fréquence de sortie.

Fig. 4. Gamme de balayage PM 5108 L

Service manual

3. Service manual

3.1. DESCRIPTION OF THE CIRCUIT DIAGRAM (Fig. 13)

3.1.1. Functional Description of Oscillator (Fig. 5.)

The oscillator circuit forms the heart of the PM 5108L function generator. Before describing the circuit diagram, a functional description of the oscillator principle is given.
The waveform generator operates on the relaxation oscillator principle whereby the selected range capacitor is first charged linearly in one direction and then charged linearly in the reverse direction to produce a triangular waveform.
The frequency is determined by the selected range capacitor and the charging current, which can be influenced by a control voltage input derived from the frequency dial setting and, if required, a sweep voltage input.

Switchover of the charging current is achieved by a two-level detector or comparator circuit which produces a reference signal when C has charged to a predetermined level. This reference signal is fed back to reverse the charge through the capacitor by means of the quadruple switch circuit.

The circuit operates as follows:

Assume that point 'b' is positive. The selected capacitor C will charge via 313 and 314 (312 and 315 are switched off). At a predetermined level, the left-hand transistor of comparator 320 will switch on and open the current switch 326. Current will flow from the central current source via 326, current mirror 329/328 and 327 to switch off the right-hand side of 320. A portion of the resulting negative voltage at point 18 is routed via 322 to point 'b'.

With a negative voltage on point 'b', the quadruple switch circuit will switch over. The selected capacitor C will now charge in the reverse direction via 312 and 315 (313 and 314 are now switched off). At a negative predetermined level, the left-hand transistor of comparator 320 will switch off and also the current switch 326. Current switch 325 will turn on because the right-hand resistor of 320 is in the "ON" state. Transistor 322 will now be cut off by the positive voltage on its base and point 'b' will again be positive.

In this way, the triangular waveform is formed, the frequency depending on the choice of charging capacitor and the magnitude of the charging current. The squarewave is produced by the right-hand side of 320 in conjunction with the current switches.

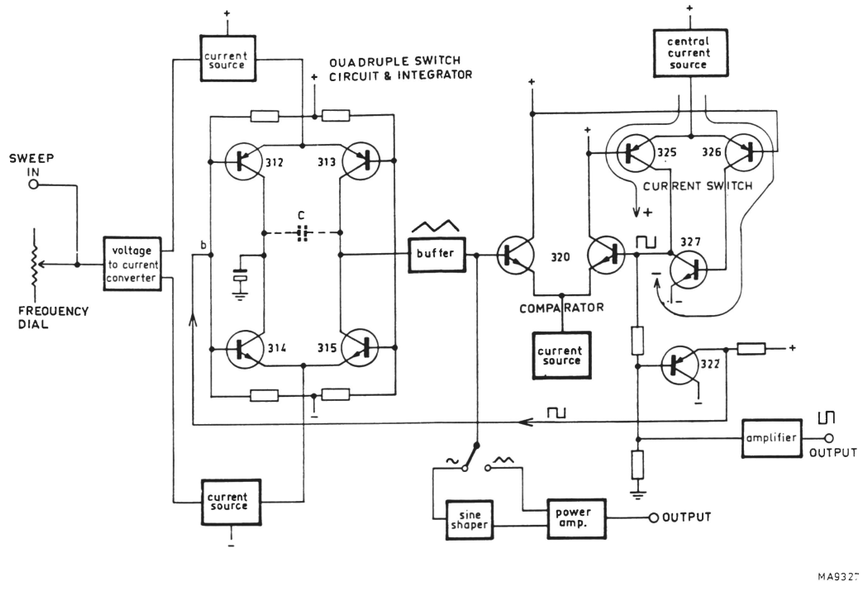
3.1.2. Control Stage

The control section of the oscillator serves to convert the control voltage from the FREQUENCY dial and the SWEEP IN socket into a constant charging current (i.e. voltage/current conversion).
The voltage at the FREQUENCY dial potentiometer wiper is derived from the +15 V, −15 V supply rails via current transistor 301, which is controlled from the central voltage reference (456, 324), and the FREQ. OFFSET control 609. The resultant control voltage of the FREQUENCY dial and the SWEEP IN voltage, at the collector of transistor 302, is applied to the + input of the operational amplifier 351.

The output of the operational amplifier drives transistor 304 and 307 via transistor 303, each of which provides a current source for loading the selected oscillator capacitor.
The current derived from the positive supply rail is via the current mirror formed by transistor 305 and diode-connected transistor 306. This current source inverts the polarity and provides a linear charging current, which is influenced by the input control voltage.

3.1.3. Quadruple Switching and Symmetrical Feedback Control Signal

The basic part of the oscillator is the quadruple switch circuit and the frequency determining capacitors, 507 ... 514, that are selected by the front-panel frequency-multiplier pushbuttons.
Under the control of the squarewave signal at point 'b' of the comparator (double transistor 320), at each half-cycle changeover two diagonally opposite transistor switches open while the other two diagonally opposite transistor close (i.e. 312, 315 open, 313, 314 close and alternaly 312, 315 close, 313, 314 open). In this way, during the capacitor charging period, the current direction is inverted.
To produce a triangular waveform that is time-symmetrical with respect to earth, one side of the charging capacitor has been connected to virtual earth at the gate input of FET 311. In this way, the triangular signal is taken from the active side of the charging capacitor with respect to the 0 V line.



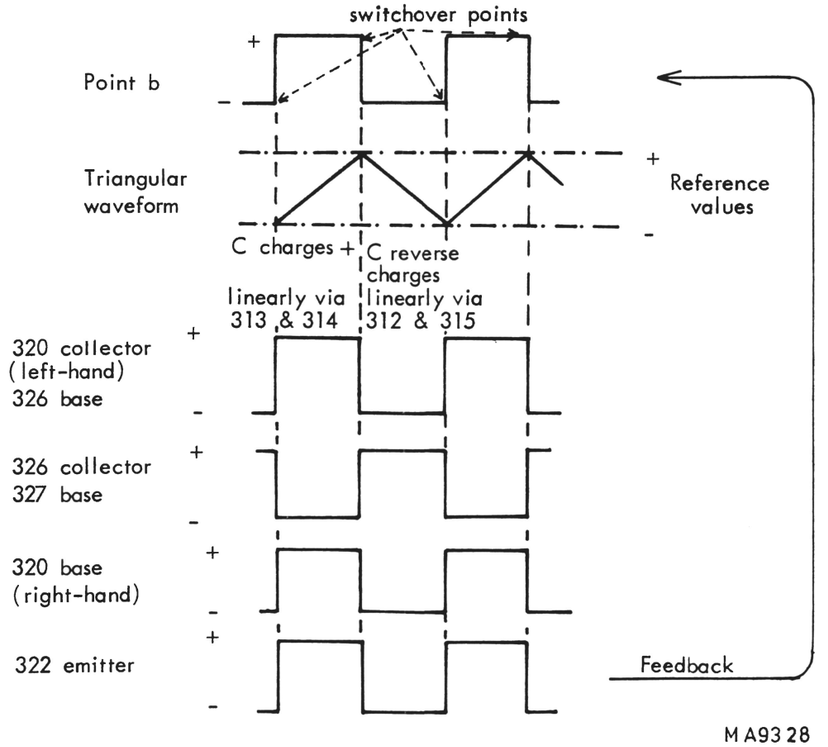


Fig. 5. Functional diagram of oscillator.

The pushbutton switches FREQUENCY Hz each select a different charging capacitor. In addition, for the lowest two ranges, which use the larger integrating capacitors, extra contacts switch in preset controls in the emitter circuit of 301 that provide individual adjustment of the charging current. These presets are 732 for the x1 range and 734 for the x10 range, and are connected in series with the FREQ. OFFSET. For all other ranges, a fixed resistor, 735, is used for frequency determining.
The symmetry control circuit 308 to 311 has been introduced to equalise for any inaccuracies caused by distortion and unbalance. On the virtual earth side of the selected charging capacitor, the electrolytic capacitor 502 will be charged by any unbalance because it is switched between the charging capacitor and earth. This unbalance provides a control voltage for FET 311. The differential stage 308 to 311 operates as a voltage/current converter, the output either putting current into the input current source circuit or taking out of it depending on the state of the positive charging current source 303. By this means, and by employing transistors with high current characteristics in the quadruple switch circuit (i.e. negligible rest currents), any unbalance of the two loading currents is equalised, so reducing time symmetry errors of the signal.

3.1.4. Buffer Stage and High-pass Filter

To avoid charging current variations occuring on the active side of the charging capacitor, the signal is buffered by the high impedance FET stage 316.
Emitter follower 318 then connects the signal to the low-ohmic waveform switch circuit and the comparator differential stage formed by double transistor 320.

To compensate for non-linearity in the frequency response at the highest range due to circuit delays in the comparator and the quadruple switch circuit, the high-pass filter network 516, 535, 639, 712, has been inserted between the oscillator and the comparator.

3.1.5. Comparator

The comparator circuit compares the reference level at point 18, which is a squarewave symmetrical with respect to ground, against the instantaneous value of the capacitor charging potential to determine the switching points. When the comparator circuit attains one of the reference levels, it actuates the quadruple switch and, at the same time, the comparator reference level is switched to the opposite polarity.
In principle, the comparator 320 consists of a differential stage controlled by the charging potential and the reference potential. The reference potential is derived from the central current source comprising transistors 323, 324. For the positive reference value, the constant current of the central current source is routed via current switch 325 direct to the resistance divider chain 644, 645, 646, 648, and is taken from point 18. The negative reference value is derived at the same point via current switch 326 and is inverted by the current mirror formed by transistors 327, 328, 329.

Consequently, on the reference side of the comparator, squarewave signals are generated by periodic switching of the reference current.

The squarewave signals are taken from the resistance divider as follows:
- via emitter follower 322, which serves as a buffer and feeds part of the squarewave output via point 'b' to control the quadruple switches.
- the squarewave signal is routed, via a complementary emitter-coupled buffer stage 330-331, to the signal waveform switch that selects the triangular, sine or squarewave outputs.

3.1.6. Central Current Source

The central current source 456, 323,324, supplies constant current to the reference side of the comparator and also to the frequency dial potentiometer via transistor 301.
This circuit is chosen because current charges caused by drift in the reference elements produce antiphase effects in the comparator and frequency dial potentiometer.
These effects compensate for the fact that the voltage developed across the dial potentiometer is directly proportional to the frequency selected, and the reference voltage at the comparator is inversely proportional to the frequency.

3.1.7. Sine Shaper Circuit

The triangular signal is fed via the waveform selector switch, inductor 761 and resistor 711 to the monolithic sine shaper circuit block 353, input 14.
The conversion from triangle to sinewave, with a distortion factor of 0.15 % typical, is achieved by non linear waveform shaping at a diode-resistor network in the IC. The peaks of the triangular waveform are suppressed by a special compensating circuit in the integrated circuit.

Associated preset controls for shaping are potentiometers 697 and 701. The output on pin 1 is routed via a low-pass filter which serves to reduce the harmonic content of the sinwave at the highest frequencies. Preset 703 provides a control adjustment for the amplitude response. The output d.c. offset is preset to zero by 706. The emitter-follower 343 is used for impedance matching and d.c. shift. The output is fed via the waveform selector switch and front-panel AMPLITUDE control 668 to the power amplifier stage, and to the output meter circuit.

3.1.8. Power Amplifier

By the AMPLITUDE potentiometer the level of the selected signal is set. Transistor 336 together with transistor 337 form a differential input stage of the amplifier. The base of 337 is controlled by the DC OFFSET output from transistor 338, when selected, and the feedback loop of the power amplifier.
The collector outputs of the differential amplifier are directly connected to the driver transistor 339. Transistor 339 drives the complementary emitter-follower output stage 340, 341. Resistor 716 serves to regulate the working point of the output stage in accordance with the d.c. offset voltage superimposed on the output. When the DC OFFSET control is in the OFF position (fully clockwise), the switch connects the junction of diode 460 and resistor 745 to the base of 338. In this position the amplifier output is set to zero d.c. by potentiometer 672.

3.1.9. Output Meter Stage (unit 2)

The output from the AMPLITUDE control is fed via line 'e' to the base of emitter-follower 361, which provides a non-reactive impedance converter. The emitter output is coupled via a high-frequency compensated voltage divider (resistor 721, capacitor 562 and resistor 722), to the base of 362. Transistors 362 and 363 from a differential amplifier to produce a constant voltage, proportional to the output signal, across capacitor 563. On positive excursions of the output signal, the base of 362 is positive-going and the transistor conducs. As 362 collector goes negative, the base of 364 also goes negative and 364 conducts and charges capacitor 563 positively as a result.
On negative excursions of the output signal, 362 base is negative-going and the transistor becomes non-conducting. The differential action due to the potential on the base of 363 ensures a constant potential across 563, proportional to the open output signal voltage.
The meter effectively reads the d.c. current, driven by the voltage at capacitor 563, flowing through series resistors 725 and 727. As the value of the resistors is approximately 20 kΩ and the full scale deflection of the meter is 100 μA, it follows by Ohm's Law that the potential developed across capacitor 653 is approximately 2 V for a full-scale reading. This represents an output signal voltage of 20 V_{pp}. The meter is calibrated to full-scale by potentiometer 727 and to 1/10 of full-scale by potentiometer 728.

In the x1 range (i.e. for very low frequency oscillations) the meter is inoperative because field-effect transistor 365 in the meter path is cut off. In the other ranges, 365 is conductive because the gate-source voltage is approximately 0 V. In the x1 range, the potential across resistors 731 and 732 increases and the gate-source voltage of approximately −2.5 V cuts off transistor 365.

3.1.10. Power Supply

The power supply provides complementary d.c. outputs of +15 V and −15 V from a zero-symmetrical circuit using an integrated circuit block, 352, for stabilisation.
The mains transformer, 751, permits either 230 V or 115 V a.c. mains input to be selected by choice of connections on the twin primary windings.
Protection is given by a thermal fuse, located on the transformer and connected in series with the POWER switch.

Twin secondary windings supply diode-bridge rectifiers 401 and 402 for the +15 V and −15 V outputs respectively.
Under the control of integrated circuit 352, series transistor 334 provides the stabilised output for the +15 V rail and series transistor 335 provides the stabilised output for the −15 V rail.
Preset adjustment of the +15 V and −15 V outputs is provided by potentiometers 663 and 666 respectively.

3.2. GAINING ACCESS TO THE PARTS

3.2.1. Cabinet

The upper and lower plates are fixed to the rear by means of 2 screws each.

3.2.2. Knobs

- Remove the cap from the knob
- Unscrew the nut and remove the knob
- When mounting the knob back, make sure that the white marks appear at the correct side

3.2.3. Textplate

- Remove upper and bottom plate
- Remove all knobs
- Carefully remove the ornamental frame
- Remove the textplate

3.3. REPLACING A SWITCH OF THE PUSH-BUTTON UNIT

- Straighten the 4 retaining lugs of the relevant switches as shown in Fig. 6.
- Break the body of the relevant switch by means of a pair of pliers and remove the pieces. The soldering pins are then accessible.
- Remove the soldering pins and clean the holes in the printed-wiring board (e.g. with a suction soldering iron)
- Solder the new switch onto the printed-wiring board
- Bend the 4 retaining lugs back to their original positions

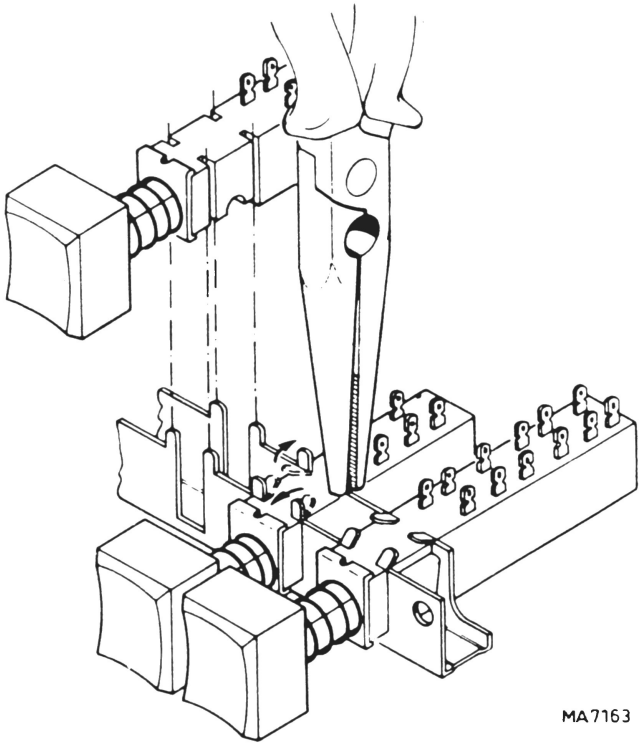


Fig. 6. Replacing a push-button switch

Seq.	SETTING													MEASURING			ADJUSTMENT
	PUSH-BUTTONS						CONTROLS				SOCKETS			Measuring point	Measured value	Explanation	Position no.
	FREQ. Hz	ATTENUATION 20 dB	ATTENUATION 40 dB	WAVEFORMS			FREQ.	FREQ. OFFSET	DC OFFSET	AMPLI-TUDE	SWEEP IN	OUTPUT Z_o 50Ω	OUTPUT Z_o 600 Ω				
	851	852/1	852/2	852/3	852/4	852/5	607	609	678	668	871	872	873				
1	x1k					x	1			Max.			600 Ω	Cap. 532 (–)	$U_- = -(15 \pm 0{,}1)$ V	$\Delta U = \lvert U_- \rvert - \lvert U_+ \rvert$; V(dc)	666
2	x1k					x	1			Max.			600 Ω	Cap. 531 (+)	$U_+ = 15$ V; $\Delta U < 0{,}1$ V		663
3	x1				x		0,1							18	$U_{pp} = (4{,}64 \pm 0{,}02)$ V	$U_{pp} = \lvert U_+ \rvert + \lvert U_- \rvert$ DV (dc)	652
4	x10k					x	< 0,1	0					C	Z_o 600 Ω	Δf	Turn control FREQ. as far that the counter just shows a deviation Δf. Then, at this point, adjust thet dial at approximately 2 scale marks below the lowest indication mark (0,1)	dial FREQ
5	x1k					x	10	0					C	Z_o 600 Ω	f = (10,00 ± 0,05) kHz		606
6	x1k					x	0,5	0					C	Z_o 600 Ω	f = (500,0 ± 2,5) Hz		608
7	x10					x	10	0					C	Z_o 600 Ω	T = (10,00 ± 0,05) ms		734
8	x1					x	10	0					C	Z_o 600 Ω	T = (100,0 ± 0,5) ms		732
9	x1k					x	1,2...10	0					C	Z_o 600 Ω	f = f_o ± 1,5 % ± 0,9% of end of range value	Permissible tolerance: ± 1,5 % of the set frequency f_o, ± 0,9 % of end of range value (= 90 Hz)	–
10	x100					X	10	0					C	Z_o 600 Ω	f = (1000 ± 25) Hz		–
11	x10k					x	10	0					C	Z_o 600 Ω	f = (100,0 ± 2,5) kHz		–
12	x100k					x	7	0					C	Z_o 600 Ω	f = 700 kHz ± 0,5 %	See explanation according to seq.no. 13	507
13	x100k					x	1/10	0					C	Z_o 600 Ω	f_1 = (100 - 8) kHz f_{10} = (1000 + 40) kHz	If required, repeat adjusting 12. The adjusting frequency must be changed to e.g. 600 kHz ± 0,5 % when f_1 is out of tolerance and to e.g. 200 kHz ± 0,5 % when f_{10} is out of tolerance.	
14	x100					x	10	+5 % –5 %		Max.			C	Z_o 600 Ω	Δf (4,5 ... 5,5) %		–
15	x1k					x	1	0		Max.	+4,5 V		C	Z_o 600 Ω	f = (10 ± 2) kHz		–
16	x1k				x		10		OFF	Max.			V(dc)	Z_o 600 Ω	U= 0 ... –30 mV		672
17	x100	–	–	x			10		OFF	Max.			KF/Osc.	Z_o 600 Ω	k ⩽ 0,2 %	Optically well-adjust the sine-wave shape on the scope; optimalize the peaks.	697/701
18	x10k	–	–	x			10		OFF	Max.			600 Ω	Z_o 600 Ω	k < 0,25 %		697
19	x100k	–	–	x			3		OFF	Max.			600 Ω KF	Z_o 600 Ω	k < 1,5 %		–
20	x1k	–	–	x			10		OFF	Max.			V(dc)	Z_o 600 Ω	U < 30 mV		706
21	x100k	–	–		x		10		OFF	Max.			600 Ω PD+DV(dc)	Z_o 600 Ω	$\frac{U_1\ MHz}{U_1\ kHz} = 1\ {}^{-0{,}01}_{\ \ \ \

3.5. PARTS LISTS

3.5.1. Mechanical

Item	Fig.	Qty	Order number	Description
1	8	1	5322 498 54032	Handle assembly
2	10	1	5322 520 34139	Bearing bush, left
3	10	2	5322 535 74367	Spindle for handle
4	8	1	5322 447 94351	Top cover
5	8	1	5322 447 94351	Bottom cover
6	8	4	5322 462 44121	Foot
7	8	4	5322 492 64338	Leaf spring for foot (item 6)
8	8	1	5322 414 74014	Cap for knob (item 17)
9	8	1	5322 414 74042	Cap for knob (item 16)
10	8	2	5322 414 74015	Cap for knob (item 18)
11	8	1	5322 460 64002	Ornamental frame
12	9	2	5322 460 64003	Ornamental strip
13	10	2	5322 498 74003	Cap for handle
14	10	1	5322 520 34138	Bearing bush, right
15	8	1	5322 414 74047	Arrow
16	8	1	5322 414 34196	Frequency dial with control knob
17	8	1	5322 414 34082	Control knob

Fig. 8. Front view, mechanical components

18	8	2	5322 414 34075	Control knob
19	11	2	5322 462 34152	Mounting support
20	8	3	5322 532 50824	Insulating bush
21	8	1	5322 455 74061	Text plate
22	10	1	5322 532 24392	Spacer for mounting mains switch
23	8	1	5322 276 14128	Mains switch (854)
24	8	3	5322 267 10004	BNC-connector
25	9	1	5322 325 50101	Strain relief grommet
26	11	2	5322 255 44064	Heat sink
27	11	2	4822 255 40115	Mounting set
28	11	6	5322 255 44069	Transistor spacer
29	11	1	5322 255 44107	IC-holder
30	11	1	5322 276 64016	Pushbutton switch unit (851)
31	8	1	5322 276 54024	Pushbutton switch unit (852)
32	10	1	5322 447 94363	Protecting cover
33	8	11	5322 414 25507	Pushbutton
34	10	3	5322 532 64214	Insulating disc for mounting the BNC connectors

3.5.2. Miscellaneous

35	8	1	5322 344 64099	Meter
36	10	1	5322 146 24109	Mains transformer
37	9	1	5322 321 14001	Mains cable
38	10	1	4822 252 20001	Thermal fuse

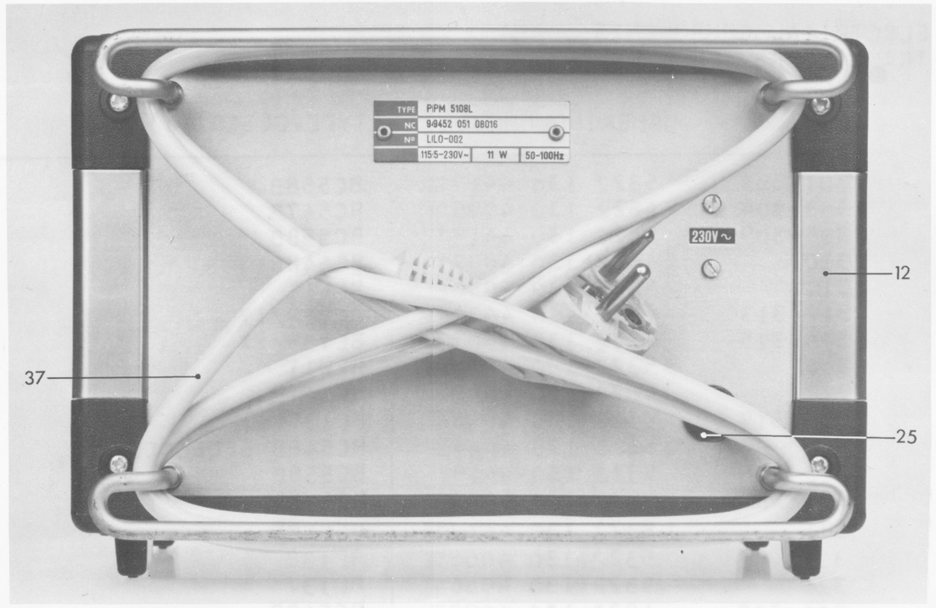


Fig. 9. Rear view, mechanical components

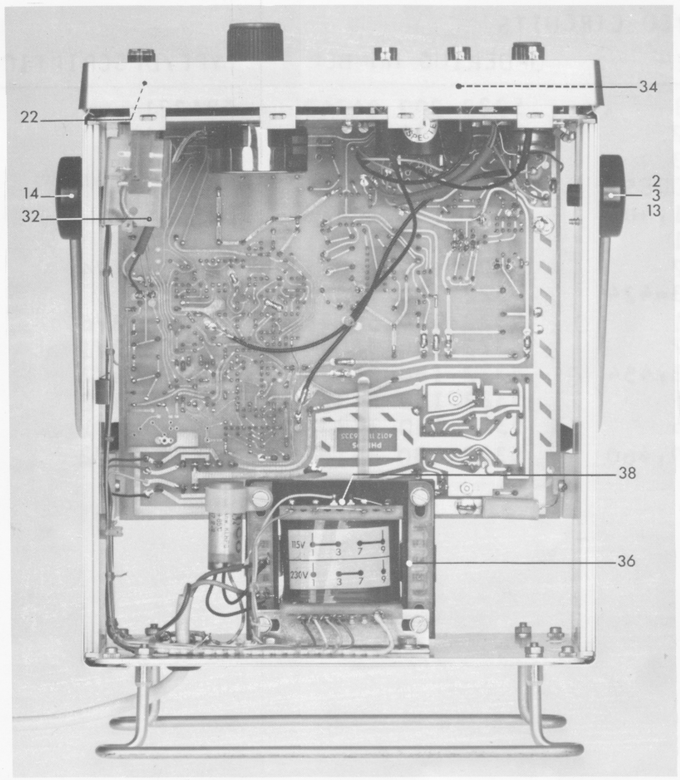


Fig. 10. Bottom view, mechanical components

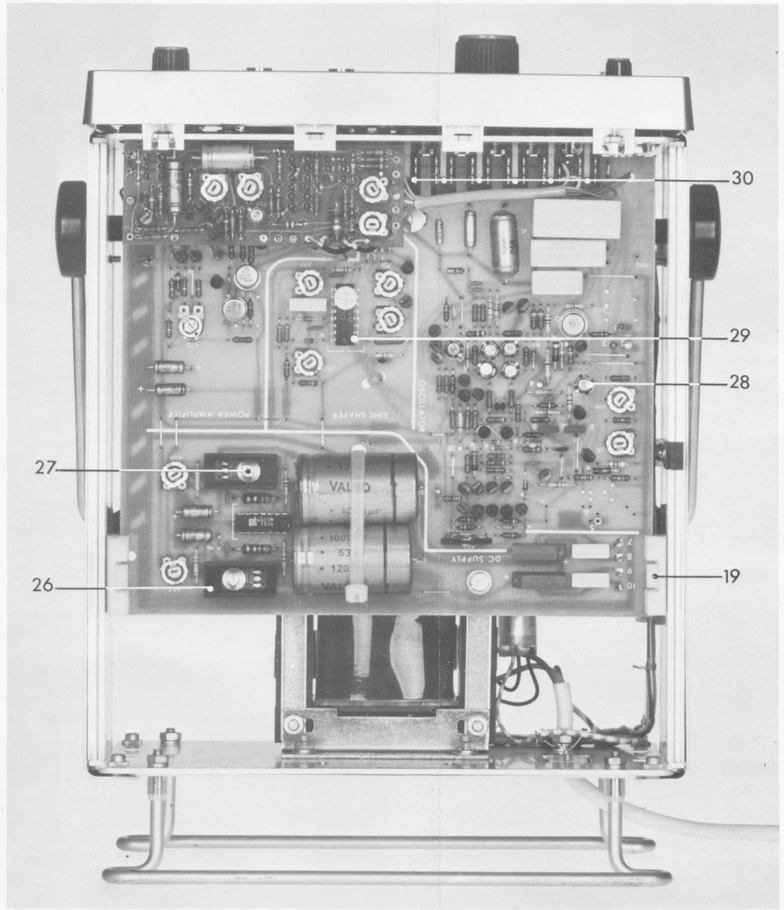


Fig. 11. Top view, mechanical components

ELECTRICAL COMPONENTS

TRANSISTORS

ITEM	ORDERING NUMBER	TYPE/DESCRIPTION
301,302	5322 130 44197	BC558B
303,304	4822 130 40959	BC547B
305-309	5322 130 44197	BC558B
310	4822 130 40937	BC548B
311	5322 130 40408	BFW11
312,313	5322 130 44322	BCY79/IX
314,315	5322 130 44073	BCY59/IX
316	5322 130 40408	BFW11
317	4822 130 40959	BC547B
318,319	5322 130 40664	BD137
320	5322 130 44442	BC548B SELECTED
322-326	5322 130 44197	BC558B
327-330	4822 130 40937	BC548B
331	5322 130 44197	BC558B
334	5322 130 40665	BD138
335	5322 130 40664	BD137
336-338	4822 130 40937	BC548B
339	4822 130 40962	BC558A
340	5322 130 44034	2N2219A
341	5322 130 40468	2N2905A
342	5322 130 44256	BC557
343	4822 130 40959	BC547B

INTEGRATED CIRCUITS

ITEM	ORDERING NUMBER	TYPE/DESCRIPTION
351	5322 209 84342	TBA221
352	5322 209 84715	SG4501N
353	5322 209 84778	OQ011
DIODES		
401,402	5322 130 30414	BY164
421	5322 130 34321	1N4151
422	5322 130 34047	BZX75-C1V4
423-424	5322 130 34321	1N4151
451	5322 130 30765	BZX75-C3V6
452	5322 130 34049	BZX75-C2V1
453,454	5322 130 34174	BZX79-C4V7
455	5322 130 34382	BZX79-B8V2
456	5322 130 34233	BZX79-B5V1
459,460	5322 130 34167	BZX79-B6V2

CAPACITORS

ITEM	ORDERING NUMBER	FARAD	TOL (%)	VOLTS	REMARKS
501	4822 122 31221	1,5N	10	100	CERAMIC PLATE
502	4822 124 10204	2,2MU		16	ELECTROLYTIC TANTALUM
503,504	4822 122 31058	15P	2	100	CERAMIC PLATE
505,506	4822 122 30043	10N	-20/+80	63	CERAMIC PLATE
507	5322 125 50058	5,5-40P		100	TRIMMER
508	4822 122 31072	47P	2	100	CERAMIC PLATE
509	5322 121 54085	976P	1	125	POLYSTYRENE FOIL
510	4822 121 50097	10N	1	63	POLYSTYRENE FOIL
511	5322 121 54124	100N	1	63	POLYSTYRENE FOIL
512	5322 121 40197	1,0M	10	100	POLYESTER FOIL
513	4822 121 40252	6,8N	10	100	POLYESTER FOIL
514	5322 121 40283	3,3M	10	100	POLYESTER FOIL
515	4822 122 30043	10N	-20/+80	63	CERAMIC PLATE
516	4822 122 30101	220P	2	100	CERAMIC PLATE
517	4822 122 30103	22N	-20/+80	63	CERAMIC PLATE
518,519	4822 121 40232	220N	20	100	POLYESTER FOIL
520,521	5322 124 24067	1000M		63	ELECTROLYTIC
522	5322 124 14066	10MU		3	ELECTROLYTIC TANTALUM
523,524	4822 122 30043	10N	-20/+80	63	CERAMIC PLATE
525	4822 122 31178	680	10	100	CERAMIC PLATE
526	4822 125 50061	5,5P		100	TRIMMER
527	4822 122 30103	22N	-20/+80	63	CERAMIC PLATE
528	5322 121 40323	100N	20	100	POLYESTER FOIL
529	4822 122 30103	22N	-20/+80	63	CERAMIC PLATE
531,532	4822 124 20475	10M	25		ELECTROLYTIC
533	4822 122 30103	22N	-20/+80	63	CERAMIC PLATE
534	4822 122 31061	18P	2	100	CERAMIC PLATE
535	4822 122 31072	47P	2	100	CERAMIC PLATE
536	4822 122 31074	56P	2	100	CERAMIC PLATE
537	4822 122 31072	47P	2	100	CERAMIC PLATE
538	4822 122 30114	2,2N	10	100	CERAMIC PLATE
539,540	4822 124 20475	10M		25	ELECTROLYTIC
545	5322 121 44115	2X2500P	20 2	50	POLYESTER FOIL
555	4822 121 40176	1MU	10	100	POLYESTER FOIL

RESISTORS

ITEM	ORDERING NUMBER	OHM	TOL (%)	TYPE	REMARKS
604	4822 110 63134	10K	5	CR25	CARBON
605	5322 116 54576	2,37K	1	MR25	METAL FILM
606	4822 100 10029	2,2K	20		TRIMMING POTM
607	5322 103 64023	5K/5 WI	RE-WOUN	D POT,	WIRE-WOUND POTE
608	4822 100 10038	470	20		TRIMMING POTM
609	5322 101 24116	500/LIN	FREQ-C	FFS,PO	TRIMMING POTM
610	5322 116 54587	3,65K	1	MR25	METAL FILM
611	5322 116 54734	249K	1	MR25	METAL FILM
612	4822 110 60137	13K	5	CR25	CARBON
613	4822 110 63098	470	5	CR25	CARBON
614	4822 110 60115	2,0K	5	CR25	CARBON
615	5322 116 54557	1,21K	1	MR25	METAL FILM
616	5322 116 55073	931	1	MR24	METAL FILM
617	5322 116 54557	1,21K	1	MR25	METAL FILM
618,619	5322 116 51034	442	1	MR24	METAL FILM

ITEM	ORDERING NUMBER	FARAD	TOL (%)	TYPE	REMARKS
620,621	5322 116 54541	825	1	MR25	METAL FILM
622	5322 116 55073	931	1	MR24	METAL FILM
623	5322 116 50572	12,1K	1	MR25	METAL FILM
624	5322 116 50747	1,0 K	1	MR25	METAL FILM
625,626	5322 116 50767	2,15K	1	MR25	METAL FILM
627	5322 116 50747	1,0K	1	MR25	METAL FILM
628	5322 116 54545	909	1	MR25	METAL FILM
629	5322 116 50842	1,1K	1	MR25	METAL FILM
630	4822 110 63074	56	5	CR25	CARBON
631,632	5322 116 50767	2,15K	1	MR25	METAL FILM
633	4822 110 63074	56	5	CR25	CARBON
634	5322 116 54529	619	1	MR25	METAL FILM
635	4822 110 63081	100	5	CR25	CARBON
636	4822 110 63136	12K	5	CR25	CARBON
637	4822 110 60119	3,0K	5	CR25	CARBON
638	5322 116 54469	100	1	MR25	METAL FILM
639	5322 116 50659	511	1	MR24	METAL FILM
640	5322 116 51034	442	1	MR24	METAL FILM
641	5322 116 50459	422	1	MR25	METAL FILM
642	5322 116 50459	422	1	MR25	METAL FILM
643	5322 116 50729	4,22K	1	MR25	METAL FILM
644	5322 116 51065	133	1	MR24	METAL FILM
645	5322 116 50492	46,4	1	MR25	METAL FILM
646	5322 116 54997	53,6	1	MR24	METAL FILM
647	4822 110 60131	7,5K	5	CR25	CARBON
648	5322 116 50344	267	1	MR24	METAL FILM
649	4822 110 60106	910	5	CR25	CARBON
650	5322 116 54882	715	1	MR24	METAL FILM
651	5322 116 54288	590	1	MR24	METAL FILM
652	4822 101 10007	10K	20		TRIMMING POTM
653	5322 116 50664	2,05K	1	MR25	METAL FILM
654	5322 116 54882	715	1	MR24	METAL FILM
655	4822 110 63112	1,5K	5	CR25	CARBON
656	4822 110 63085	150	5	CR25	CARBON
657	5322 116 54529	620	5	CR37	METAL FILM
658	4822 110 63092	270	5	CR25	CARBON
659,660	4822 110 63081	100	5	CR25	CARBON
661	5322 113 44157	1,6	5		WIRE-WOUND
662	5322 113 44156	1,3	5		WIRE-WOUND
663	4822 100 10051	22K	20		TRIMMING POTM
664	4822 110 63156	68K	5	CR25	CARBON
665	4822 110 63174	330K	5	CR25	CARBON
666	4822 100 10079	47K	20		TRIMMING POTM
667	5322 116 50675	2,26K	1	MR25	METAL FILM
668	4822 101 20297	2,2K	20		CARBON POTM LIN
669	4822 110 60066	30	5	CR25	CARBON
670	5322 116 54442	51,1	1	MR25	METAL FILM
671	5322 116 54486	150	1	MR25	METAL FILM
672	5322 101 14004	47/LIN	CARBON	POTM.	TRIMMING POTM
673	5322 116 54549	1K	1	MR25	METAL FILM
674	5322 116 54192	5,11	1	MR25	METAL FILM
675	5322 116 50729	4,22K	1	MR25	METAL FILM
676,677	5322 116 50747	1,0K	1	MR25	METAL FILM
678	5322 101 44029	10K/LIN	,POT.WITH SWI		TRIMMING POTM
679	5322 116 50484	4,64K	1	MR25	METAL FILM
680	5322 116 50747	1,0K	1	MR25	METAL FILM

ITEM	ORDERING NUMBER	OHM	TOL (%)	TYPE	REMARKS
681	5322 116 54005	3,32K	1	MR25	METAL FILM
682	5322 116 50579	3,16K	1	MR25	METAL FILM
683	4822 110 63072	47	5	CR25	CARBON
685	5322 116 54612	8,45K	1	MR25	METAL FILM
686-687	5322 116 50452	10	1	MR25	METAL FILM
688	5322 116 50876	26,1	1	MR25	METAL FILM
689	5322 116 50571	715	1	MR25	METAL FILM
690-691	5322 116 54192	5,11	1	MR25	METAL FILM
697	4822 100 10038	470	20		TRIMMING POTM
698	5322 116 54613	8,66K	1	MR25	METAL FILM
699	4822 110 63169	220K	5	CR25	CARBON
700	5322 116 54587	3,65K	1	MR25	METAL FILM
701	4822 100 10038	470	20		TRIMMING POTM
702	5322 116 50635	1,47K	1	MR25	METAL FILM
703	4822 100 10036	4,7K	20		TRIMMING POTM
704	4822 110 63125	4,7K	5	CR25	CARBON
705	4822 110 63138	15K	5	CR25	CARBON
706	4822 100 10019	220	20		TRIMMING POTM
707	4822 110 63058	15	5	CR25	CARBON
708	4822 110 63112	1,5K	5	CR25	CARBON
709	5322 116 50635	1,47K	1	MR25	METAL FILM
710	5322 116 50508	487	1	MR25	METAL FILM
712	5322 116 50557	46,4K	1	MR25	METAL FILM
713	5322 116 54562	1,4K	1	MR25	METAL FILM
715	4822 110 63129	6,8K	5	CR25	CARBON
716	5322 116 54459	75	1	MR25	METAL FILM
720	4822 110 53161	100K	5	CR37	CARBON

ITEM	ORDERING NUMBER	TYPE/DESCRIPTION
COILS		
761	5322 158 10276	4,7 MµH
762	5322 158 14034	220 MµH
UNIT 2		
ELECTRICAL COMPONENTS		
TRANSISTORS		
361	5322 130 44197	BC558B
362-363	4822 130 40937	BC548B
364	5322 130 44197	BC558B
365	5322 130 40516	BFW13
DIODES		
460	5322 130 34321	1N4151

ITEM	ORDERING NUMBER	FARAD	TOL (%)	VOLTS	REMARKS
CAPACITORS					
560	5322 124 20371	47MU		25	ELECTROLYTIC
561	4822 122 31063	22	2	100	CERAMIC PLATE
562	4822 122 31067	33	2	100	CERAMIC PLATE
563	4822 124 20589	220MU		10	ELECTROLYTIC
RESISTORS					
720	5322 116 50524	3,01K	1	MR25	METAL FILM
721	5322 116 54567	1,69K	1	MR25	METAL FILM
722	5322 116 54585	3,48K	1	MR25	METAL FILM
723	5322 116 54619	10K	1	MR25	METAL FILM
724	5322 116 50484	4,64K	1	MR25	METAL FILM
725	5322 116 54635	16,9K	1	MR25	METAL FILM
727	4822 100 10036	4,7K/LIN		CARBON POTH	TRIMMING POTM
728	4822 100 10075	100/LIN		CARBON POTH	TRIMMING POTM
729	5322 116 54698	105K	1	MR25	METAL FILM
730	5322 116 54694	90,9K	1	MR25	METAL FILM
731	5322 116 54592	4,02K	1	MR25	METAL FILM
732	4822 100 10029	2,2K/LIN		CARBON POTH	TRIMMING POTM
733	5322 116 54592	4,02K	1	MR25	METAL FILM
734	4822 100 10029	2,2K/LIN		CARBON POTH	TRIMMING POTM
735	5322 116 50509	4,87K	1	MR25	METAL FILM
736	5322 116 54448	59	1	MR25	METAL FILM
737	5322 116 50679	237	1	MR25	METAL FILM
738	5322 116 54527	576	1	MR25	METAL FILM
739	5322 116 54501	255	1	MR25	METAL FILM
740	5322 116 54034	31,6	1	MR25	METAL FILM
741	5322 116 50524	3,01K	1	MR25	METAL FILM
742	5322 116 54437	30,9	1	MR25	METAL FILM
744	5322 116 54712	147k	1	MR25	METAL FILM
745	5322 116 54005	3,32K	1	MR25	METAL FILM

Tight transistors 334 and 335 with a torque of 0,5 ... 0,6 Nm.

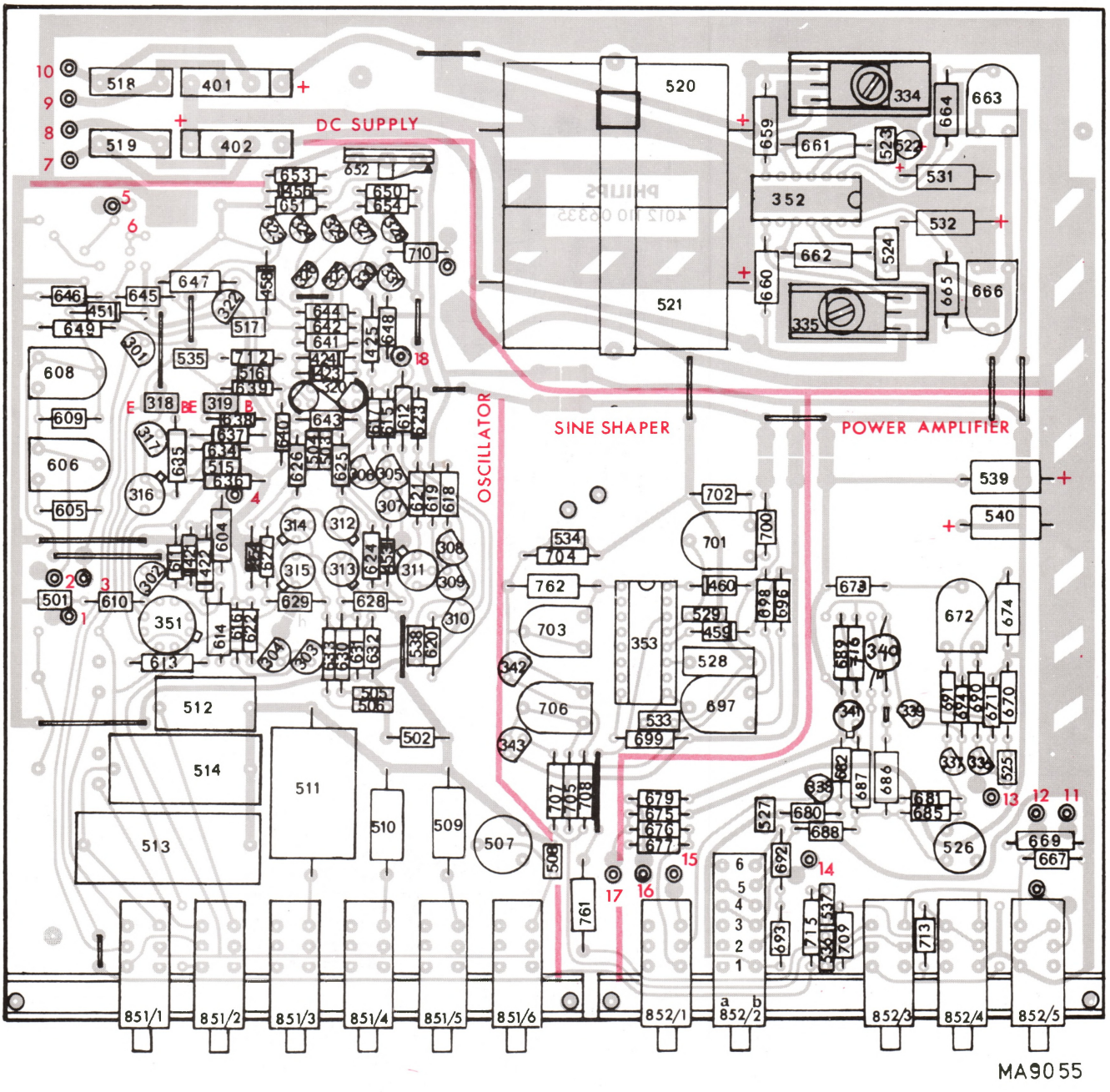


Fig. 12. Printed wiring-board, Unit 1

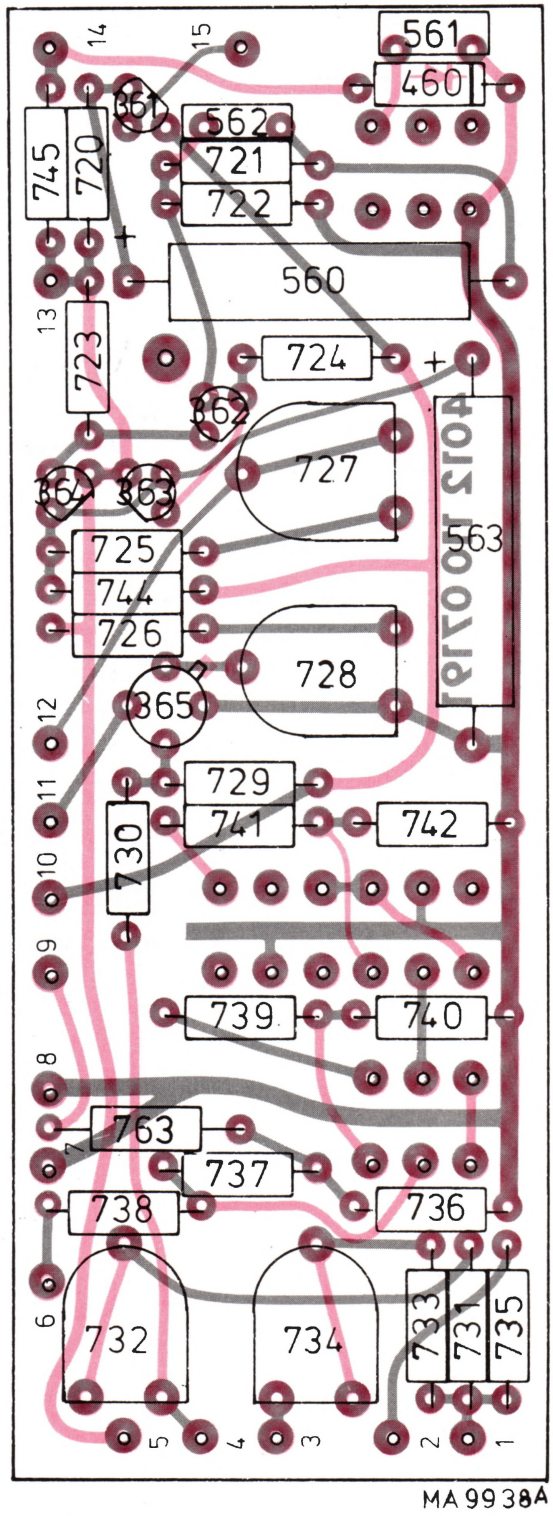
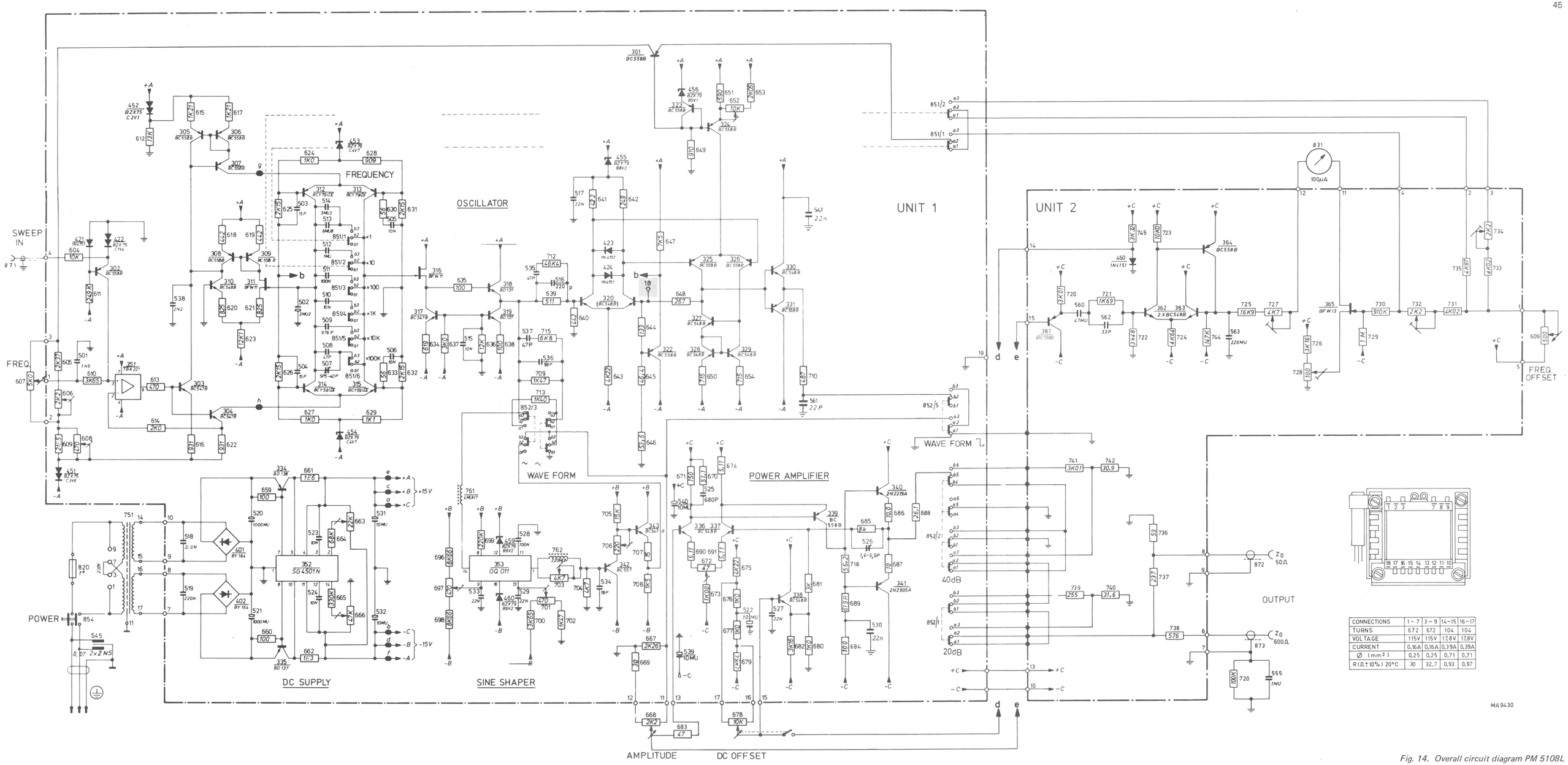


Fig. 13. Printed wiring-board, Unit 2



CONNECTIONS	1 – 7	3 – 9	14–15	16–17
TURNS	672	672	104	104
VOLTAGE	115V	115V	17.8V	17.8V
CURRENT	0,16A	0,16A	0,39A	0,39A
Ø (mm²)	0,25	0,25	0,71	0,71
R(Ω ± 10%) 20°C	30	32,7	0,93	0,97

Fig. 14. Overall circuit diagram PM 5108L

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS

(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① *Country*	② *Day Month Year*	③ *Typenumber*	*/Version*	④ *Factory/Serial no.*
32	150475	OPM	32600 2	DO 0078 3

CODED FAILURE DESCRIPTION ⑥

⑤ *Nature of call*	*Location*	*Component/sequence no.*	*Category*
☐ Installation		TS0607	5
☐ Pre sale repair		R00631	2
☐ Preventive maintenance	0021	990001	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ ☐☐12 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 32 = Switzerland

②Day Month Year 150475 = 15 April 1975

③Type number/Version OPM32600 2 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number DO0 0783 = DO 783 These data are mentioned on the type plate of the instrument

⑤ Nature of call: Enter a cross in the relevant box

⑥ Coded failure description

Location

☐☐☐☐

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

☐☐☐☐☐☐

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric,the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

990000 Unknown/Not applicable
990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002 Knob (incl. dial knob, cap, etc.)
990003 Probe (only if attached to instrument)
990004 Leads and associated plugs
990005 Holder (valve,transistor, fuse, board, etc.)
990006 Complete unit (p.w. board, h.t. unit, etc.)
990007 Accessory (only those without type number)
990008 Documentation (manual, supplement, etc.)
990009 Foreign object
990099 Miscellaneous

Category

☐

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement (of transistor, resistor, etc.)
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

⑦ Job completed: Enter a cross when the job has been completed.

⑧ Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

☐☐12 = 1,2 working hours (1 h 12 min.)

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